SCIENTIFIC AMERICAN

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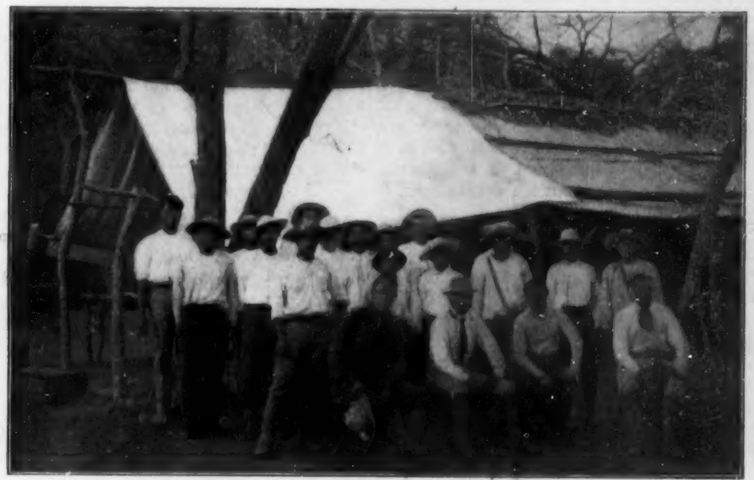
Vol. LXXXVI.—No. 5. ESTABLISHED 1845. | NEW YORK, FEBRUARY 1, 1902. | $3.00 A YEAR. 8 CENTS A COPY.

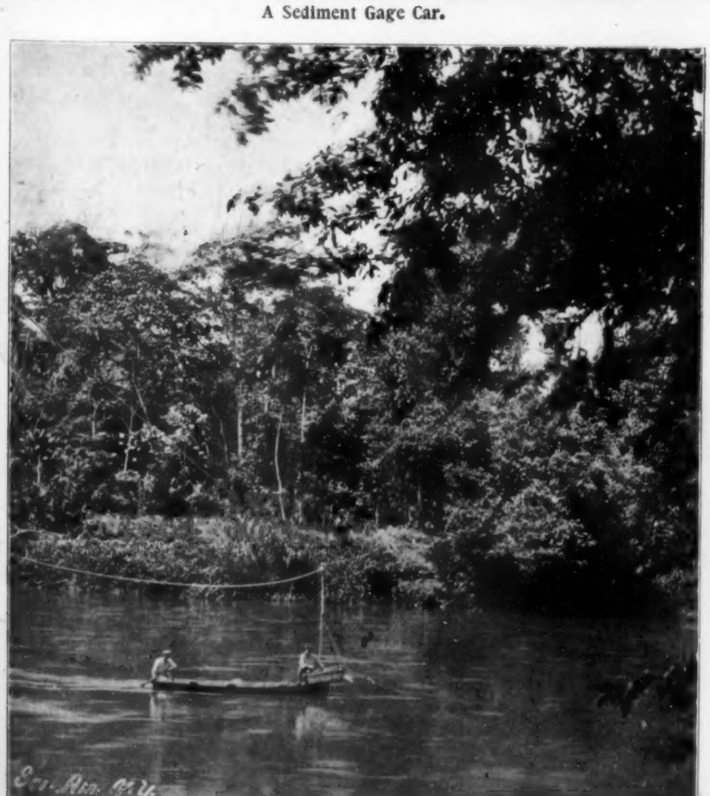
Gaging a Stream.

Leveler and Assistant.

A Sediment Gage Car.



Surveying Party in Camp.



Lowering a Sediment Gage into the River.

Aerial Trolley Car for Use in River Gaging.

SURVEY WORK OF THE ISTHMIAN CANAL COMMISSION ENGINEERS AT NICARAGUA.—[See page 73.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico	$3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d.	4.00

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Scientific American (established 1845)	$3.00	a year
Scientific American Supplement (Established 1876)	5.00	"
Scientific American Building Monthly (Established 1885).........	2.50	"
Scientific American Export Edition (Established 1878)	3.00	"

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 1, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RECOMMENDATION OF THE PANAMA ROUTE.

The Isthmian Canal Commission in a supplemental report has recommended that, in view of the new situation brought about by the offer of the Panama Company to sell its properties to the United States for $40,000,000, the sum at which they were appraised by the Commission, these properties be purchased and the canal constructed along the Panama route. This report is in no sense inconsistent with the first report of the Commission in recommendation of Nicaragua, inasmuch as it was clearly stated therein that the Panama route was excluded from consideration by the high valuation placed upon the properties by the old management of the Panama Company. Apart from this consideration, which was, of course, a fatal one, the first report of the Commission was distinctly in favor of Panama on the grounds of engineering, first cost, and cost of maintenance and operation. The findings of the supplemental report in favor of Panama are too lengthy for reproduction here, but they will be found in full in the current issue of the SUPPLEMENT. It is sufficient to say that the points enumerated in favor of Panama are those which, for several years past, we have presented in the columns of this journal.

We are free to confess that the final selection of Panama gives us unbounded satisfaction. The SCIENTIFIC AMERICAN was the first journal to publish the official plans of the location and structures of the new Panama Canal Company. From the very first time that we investigated the subject, we were satisfied that there was no question as to the proper course for the United States government to take in this matter; and we have never had a doubt throughout this long-drawn-out controversy that, when the facts came to be fully investigated, as they have now been, by an impartial and properly qualified commission of experts, final choice would be made of the shorter, better known, and more practicable route.

THE FAULTY EMBANKMENTS OF THE JEROME PARK RESERVOIR.

Too much publicity cannot be given to the present commendable attempt on the part of the Chief Engineer of the Jerome Park Reservoir to have the plans for the construction of a large part of the reservoir embankments revised, and certain portions of the structure rebuilt in accordance with the best engineering practice. It will be remembered that last autumn Mr. Hill, the present Chief Engineer, recommended important changes in the plans, both of these embankments and of the earth-and-core-wall portion of the Croton Dam. The Board of Engineers appointed to investigate the conditions of these two structures passed favorably upon the suggested changes at the Croton Dam, but stated that they considered the existing structures and plans at Jerome Park satisfactory. The Chief Engineer has submitted a reply to that portion of the report affecting Jerome Park Reservoir, in which he gives certain extracts from the diary of the Resident Engineer who had charge of the construction of the embankments which it is proposed to rebuild, which shew that the material underlying these embankments is about as bad as it could possibly be.

The embankment under discussion extends along the southerly end and easterly side of the reservoir. Its length is 2,850 feet, and for 1,200 feet, at three different places, it is built upon sand. The balance of the embankment is built upon rock foundation. The southerly end of the wall is built across a natural depression which drains down to the Harlem River. This depression is 270 feet wide, and at its deepest point there is 30 feet of quicksand between the wall and the underlying rock. Great difficulty was experienced in building the foundations across this depression. On May 20, 1897, the Resident Engineer writes in his diary: "In the core-wall trench, quicksand still causes much trouble; a large stream of water boils up in bottom and has caused settlement of the timbers. Bottom also squeezes up there and has to be weighted with planks, etc." On June 3, 1897, he writes in his diary: "Much trouble encountered in excavating, as quicksand runs in from side almost as fast as it is excavated." On September 25, 1897, this engineer enters in his diary that he noticed two hair cracks in the completed core wall; and November 12, 1897, he states that the hair cracks in masonry have opened slightly and are being pointed over with Portland cement.

Commenting on these entries and several more which we do not quote, the Chief Engineer in his reply says: "In my opinion the building of an embankment and core wall for a reservoir upon such material and under the conditions as described is a gross violation of the rules of good practice, which prescribe that a core wall should be built either upon rock or upon solid, impervious material." Mr. Hill contends that this underlying sand is permeable by water, and that when the reservoir is filled with 23 feet of water, there will be leakage under the foundations, which may easily become so serious as to imperil the whole embankment. The facts of the case as presented in the report appear amply to sustain the position of the Chief Engineer; and in view of the importance of the reservoir, and the disastrous results to New York city should there be a failure of its embankments, we trust that the Aqueduct Commissioners will see the wisdom of carrying out the reconstruction of these walls along the lines suggested. We have personally examined some of the material taken out from below the foundations in question, and have no hesitation in saying that the underlying strata at this particular portion of the dam is about the worst that could possibly be imagined. The foundation would be a poor one even if the embankments were enclosed by rising ground; but standing as they do on one of the drainage slopes of the Harlem River, the necessity of carrying the foundations through this quicksand to solid rock should not be questioned.

LONG DISTANCE TRANSMISSION.

To the city of San Francisco is shortly to belong the distinction of being served by considerably the longest transmission of electrical power in the world. Hydraulic-electric power has for several weeks been carried in California for a distance of over two hundred miles. The credit of this installation is due to the Bay Counties Power Company, California, whose line extends from the Colgate power house located in the Sierra Nevada Mountains to Oakland on San Francisco Bay, a distance of 142 miles. At this city the lines connect with those of the Standard Electric Company, which reach from Oakland to San José, a further distance of 42 miles, and thence to Redwood City, which is distant 191 miles from the Colgate power house. At Colgate connection is made with the lines of the Consolidated Light and Power Company, which extend to Burlingame, a further distance of 11 miles. The total distance of transmission thus accomplished is 202 miles. The completion of the high-tension line of the Standard Electric Company to San Francisco, which it was announced would be made this month, will render possible transmission from the power house in the Sierra Nevada Mountains to the sub-station in San Francisco, a distance of 220 miles. This feat, which is quite without a parallel, will be naturally compared with the Lauffen-Frankfort transmission of 110 miles, which was made in 1891, and it will be seen that the distance has been doubled in about a decade. The explanation of the great distance to which transmission has been successfully accomplished in California is to be found partly in the favorable climatic conditions of that State.

ADVANCE OF THE MARINE TURBINE

It was inevitable that the success of the "King Edward" during the past season should encourage the construction of other turbine-propelled vessels; hence, we are not surprised to learn that another river passenger steamer similar to the "King Edward" has been ordered. The new craft will be of large dimensions and will have one knot more speed, or 21½ knots an hour, and the horse power will be about 4,000. The absence of vibration is, of course, a strong recommendation for the application of turbine propulsion to the steam yacht, for here comfort is a prime consideration, and we note that orders have been placed for turbine engines for three yachts of high speed. One of these, which is being built for a New York owner, will be a 1,400-ton yacht of 3,500 horse power. Of the other two, which are being built for British owners, one will be of 700 tons displacement and 15 knots speed, and the other, which is to be constructed on the lines of a torpedo boat, and carry Yarrow water-tube boilers, is to be of 170 tons and will attain a speed of 24 knots. The next step in the application of turbine propulsion should be the construction of an ocean-going steamer of 4,000 or 5,000 tons displacement. With a ship of this size it would be possible to determine with pretty close certainty whether the equipment of a 10,000 or 15,000-ton liner with turbine engines would be a profitable experiment.

THE SHIP SUBSIDY BILL.

It sometimes happens that in response to the question, "What's in a name?" we have to answer, "Just everything." There is now up for discussion in Congress a measure which we do not hesitate to designate as one of the most important ever brought before that body, that is in danger of suffering shipwreck simply and solely because of the unfortunate name which it carries. Unfortunately a large number of the American people have conceived a violent prejudice against the term "subsidy." Apparently they look upon subsidizing as a kind of alms-giving, a sort of feudal scattering of largess, with the difference that the recipients, instead of being supposedly impoverished and helpless, are among the powerful and wealthy of the land. As a matter of fact, shipping subsidies mean nothing of the kind. They are based upon the conviction that between the individual ship-owner and the nation at large there is, in respect of the upbuilding and extending of the shipping industry, with all the indirect and enormous national benefits that are to be derived therefrom, a profound community of interest. It is realized that the assistance given by the nation to the ship-owner is to be temporary only, and that in its intrinsic value it is altogether disproportionate to the great and lasting national advantages to be derived from the rehabilitation of the merchant marine.

In discussing the subject it is best, at the outset, to distinguish clearly between our "lake and coastwise" and our "deep-sea" shipping. The former is wonderfully prosperous; the latter is not; and the difference is due to that very condition of things which the pending subsidy bill is expected to remedy. Our lake and coastwise shipping is protected against foreign competition by an ironclad law which prohibits foreign ships engaging in the lake and coastwise trade; and the stimulating effect of this law is seen in the fact that this branch of the shipping interests of the country is in a flourishing condition, and although it is highly remunerative, there has been a steady reduction of rates. In 1870 it cost as high as $3.50 to transport a ton of freight from Lake Superior to ports on Lake Erie, while to-day the ruling rate is from 60 cents to $1 per ton.

Our merchant marine, on the other hand, is in direct competition with that of foreign nations, who are able to build and operate their ships so much more cheaply than ourselves that it is out of the question to compete successfully against them; and the object of the ship subsidy bill is to make up, by a certain schedule of payments to the ship-owners, the actual loss to which they would be exposed were they to attempt competition on a large scale with foreign ship-owners. The proposal to extend government aid is qualified by the understanding that such assistance is only to be rendered until we have moved up to our proper position among the maritime nations of the world. Long before our deep-sea shipping has increased to the magnitude of the lake and coastwise shipping, the cheapening of the cost of production which we may reasonably expect to follow the introduction of American labor-saving devices into shipyard work, will place us in a position where we can compete successfully with foreign shipyards. By that time the ship-building industry will be strong enough to hold its own without government assistance. The sum spent in subsidies should be looked upon as a very small price to pay for the multiplied benefits that will accrue from the resumption of our former proud position as the leading maritime nation of the world.

Our present disadvantageous position is shown by the following facts: While the raw materials of ship construction cost but little more in this country than abroad, the cost of labor is so much greater that the final cost per ton of the vessel at the time of launching is 20 per cent more here than abroad. From the report of the Commissioner of Navigation on the subject, we learn that the cheapest cargo steamer ever built in this country, the "Pleiades," of 3,750 tons and 9¾ knots speed, cost $275,000, while the British cargo steamer "Masconomo," of 4,200 tons and 10 knots speed, cost only $217,000. The annual charges on the "Pleiades" are $44,000; on the "Masconomo," $34,240. The total annual wages for the crew of the "Pleiades" amount to $14,588; while the total annual wages on the larger ship amount to only $11,751. As a result of the Commissioner of Navigation's inquiry, it was shown that there is an average difference in favor of Great Britain of 20 per cent in the cost of constructing cargo steamers, and of 33½ per cent in the cost of operation.

Under such conditions profitable competition with Europe is simply out of the question, and American capital has naturally found its way into the protected and highly remunerative coastwise shipbuilding and carrying trade. As the result of our withdrawal from, or rather failure to enter, the competition for the world's carrying trade, we are paying out annually the huge sum of $200,000,000 to foreign ship-owners for carrying our great and growing volume of exports to foreign countries. In the presence of this start-

ling fact, we are brought face to face with the question as to whether it is consistent with the dignity, and conducive to the best commercial interests of the country, that we should be indebted to foreign nations for the transportation of the products of our fields and factories, and that we should be paying out this great sum of money to foreign firms, when it might just as well form part of the legitimate annual profits of American industry. There are some Americans, it is true, who frankly assert that they are content to let matters remain as they are; but we must not forget that their attitude means the indefinite postponement of any revival of American deep-sea shipping, and that we, who before the days of our civil war were the greatest deep-sea carrying nation in the world, must be content, in spite of our ever-increasing wealth and importance, to continue to hold an inferior position.

The resuscitation of our merchant marine has an important bearing on our position as a naval power. An adequate merchant marine is necessary to any naval country that is to be in a position to transport its troops with speed and safety to a distant center of operations. We all remember the difficulty which we experienced in carrying troops to Cuba, Porto Rico and the Philippines during the late war; and now that we have extensive foreign possessions, the value of an adequate auxiliary navy has increased enormously. A consideration of the problems of transportation which would suddenly confront us were the Philippines, for instance, made the object of attack by a foreign power, should prove to us the wisdom of subsidizing fast and well-built merchant ships which, in the time of war, could be quickly armed and utilized as consorts to the slower transports, in which troops and munitions of war would be carried.

Lastly, it should be borne in mind that since practically the whole of our foreign trade is carried in foreign bottoms, a war between any of the maritime nations would result in a paralysis of deep-sea commerce and a temporary extinction of our export trade. On the other hand, if we possessed our own merchant fleet, we could view such a struggle in its effect upon our carrying trade with comparative equanimity.

THE SUPPOSED DANGERS OF ELECTRIC TRACTION.

The letter from Mr. George Westinghouse, which recently appeared in one or two papers, calling attention to certain dangers incident to electric traction, has naturally attracted widespread attention. It has, moreover, aroused a considerable amount of apprehension in view of the fact that electric traction seems destined to become adopted for all forms of railroad travel, short of that now carried on over the long-distance trunk lines of the country. This apprehension, while it is proportionate to the great reputation of Mr. Westinghouse, is out of all proportion to the actual facts of the case, for we feel satisfied that the dangers hinted at are neither so many nor so great as the letter of this distinguished engineer might lead the general public to suppose. Mr. Westinghouse believes that not only would the recent tunnel accident have been as likely to occur had electric traction instead of steam traction been employed, but that in an electrically-operated train the risk of accident would be increased rather than diminished, and this in spite of the fact that no injury from escaping steam would be possible. He suggests that in a train of combustible cars, electrically-equipped throughout, there might be an accident so serious as to start "an agitation having for its purpose the abolition of the use of electricity altogether or at least to compel the railway companies to abandon the use of combustible cars fitted with electric motors."

We are satisfied that Mr. Westinghouse's letter is in danger of conveying a stronger impression than the writer ever intended, and that the object of the letter was to utter a warning against careless and slipshod work in the equipment and operation of electric roads, rather than to condemn the whole system of electric traction as such on the ground of its inherent dangers. This we gather to be the opinion of Mr. L. B. Stillwell, the eminent electrical engineer who is responsible for the equipment of the two most important electrical roads now under construction, namely, the Manhattan Elevated system and the New York Rapid Transit Subway. In the course of an interview by a representative of the SCIENTIFIC AMERICAN with Mr. Stillwell, who may justly be regarded as the leading authority on this subject in the United States, the subject was very thoroughly discussed. His views on Mr. Westinghouse's letter and the safety of electric traction summed up concisely, are as follows: With reasonable care in installation and subsequent systematic inspection, there are fewer risks in the operation of an elevated or underground railway by electricity than with steam. When trolley cars occasionally catch fire, it will be found it is invariably due either to poor wiring, carelessness in placing resistance boxes in contact with unprotected woodwork, or to similar causes. A trolley car, electrically equipped with the same care that is insisted upon in the building of a steam locomotive, would be almost absolutely safe from accidents of this kind. As to the suggested danger of a fire resulting from collision, Mr. Stillwell affirms that he has never heard of a single instance of such an occurrence in the case of an electrically-propelled car or train. Such a result might follow collision, but the fire risk would be far less than where a steam locomotive was used. For when steam trains collide there are three distinct sources of danger: (1) the momentum of the train, (2) fire from the engine or the oil or gas lamps, (3) danger of scalding from the steam-heating pipes, or directly from the locomotive; whereas in a collision of an electric train, while the momentum may cause wreck and loss of life, the fire risk is greatly reduced, and the steam risk entirely eliminated.

The fire risk is reduced because it is an easy matter to absolutely and instantly cut off the current from the wiring in the wreck by means of automatic circuit-breaking devices of types that have been proved reliable by years of experience. The burning up of an electrical train in a tunnel at Liverpool was apparently due to the use of open or exposed fuses, which would not be used on an up-to-date equipment. With the use of automatic circuit-breakers, located in iron fireproof compartments, or of any of the properly inclosed fuses of which there are several types on the market, the risk of fire is so small as to be practically eliminated.

In the desire to attain constantly increasing speeds of operation, engineers should be governed by a due measure of conservatism, and by every reasonable precaution that can guarantee the safety of the traveling public. In the craze for high speed, engineers are sometimes in danger of losing sight of certain very practical issues in railway operation; but so long as due regard is given to measures of safety which have been proved by long experience in the operation of high-speed railways to be necessary, the conditions of high-speed electric traction are such, and the art of electrical equipment is so well advanced, that this form of travel could be made as safe as, and indeed much safer than, steam railroad travel.

In the case of an electric train wreck, the risk of fire by short-circuiting is not comparable with the risk of fire when a steam locomotive carries nearly a ton of incandescent coals into the splintered wreck of a passenger car. For in the former case the current is almost certain to be automatically cut off before the woodwork can be ignited. Moreover, in the case of the Manhattan Elevated Railroads, the third rail is divided into sections, each of which is supplied through an automatic circuit-breaker in the sub-station. With assurance thus made doubly sure, the chance of ignition of the woodwork after a smash-up is extremely remote. Applying the above considerations to the tunnel accident, while it cannot be assumed that, had the trains been electrically equipped, there would have been no accident, it is perfectly certain that had there been an accident it could not have been due to the inability of the engineer to see the signal because of smoke in the tunnel. Again, the total weight of the Harlem River train, had it been equipped with motors equal in power to the steam locomotive, would have been considerably less, and the momentum as it struck the New Haven train correspondingly smaller. While the forward cars of the Harlem train might have suffered more in the absence of the engine, it is certain that the passengers in the last car of the New Haven train would not have been killed and maimed as they were; for in an electrically-equipped train there would have been no scalding to death of passengers, and no delay in the work of rescue due to the rush of steam that drove the rescue party back and hindered their work. Finally, Mr. Stillwell combats the idea that the fires which occur now and then on trolley cars are due to collision and wreckage. They are traceable to faulty wiring, and they could be practically eliminated by care in mounting the motors and controllers, by the use of the best systems of insulation, and by systematic inspection and testing.

TWO HUNDRED THOUSAND DOLLARS IN PRIZES FOR AIRSHIPS.

It has been fully and finally determined on the part of the officers of the Louisiana Purchase Exposition Company to have a tournament of airships and an aerostatic congress at the World's Fair at St. Louis in 1903. In order to stimulate inventors along this special line of experiment, prizes aggregating $200,000 will be offered for the most successful contestants. In view of the remarkable results attained by M. Santos-Dumont at Paris last year, when he made a thirty-minute trip around the Eiffel Tower, having his airship under control during the entire journey, the coming tournament is in the line of progress. It is the desire of the officers to achieve better results than those of Santos-Dumont, and for that reason the prize is made a most liberal one.

It was early recognized by officers of the Exposition that the navigation of the air is one of the great problems for scientific solution, and that this Exposition would not fulfill its duty to the world unless it lent its encouragement and furnished an opportunity for those who are skilled in this difficult science to demonstrate the results of their endeavors. The experiments of M. Santos-Dumont have set the inventors to thinking anew upon this most interesting problem, and the tournament at the coming World's Fair will be one of the most novel in history. A cablegram from London says that Sir Hiram S. Maxim, the American inventor, has expressed himself as willing to expend $100,000 in addition to the large sums he has already laid out in experiments in aerial navigation to win in the coming contest, if assured that the prize will be as large as announced. In reply to this, President David R. Francis, of the Louisiana Purchase Exposition, is quoted as follows: "Mr. Maxim will receive all the assurance he desires when the committee on aerial experiments has crystallized the plan for the contest. If he abides by the conditions of the competition and invents an airship that will obey the directions of an operator in midair, as well as develop speed, he will be entitled to be adjudged as a real contestant.

"The total sum of $200,000 has already been set aside by the Executive Committee for the purpose of defraying the expenses of the proposed aerial tournament. Of this sum $100,000 will constitute the award for the successful operation of a craft in the air, $50,000 will be devoted to premiums for races between airships, and $50,000 to defray the expenses of the competition. We have opened correspondence with noted experts in aerial science, and the entire matter of suggestion with reference to the management of the contest will come from that authority."

Secretary Walter B. Stevens of the Exposition Company says: "The recommendation of Director of Exhibits Skiff on the subject of the airship contest has been unqualifiedly indorsed by the entire Executive Committee. Nothing in the way of a suggestion for an exposition feature has received such immediate and strong approval."

The Executive Committee of the Exposition has appointed as a sub-committee in charge of the tournament and congress, Mr. Charles W. Knapp, proprietor of the St. Louis Republic, and Nathan Frank, representing the St. Louis Star. This sub-committee has invited Prof. S. P. Langley, secretary of the Smithsonian Institution, of Washington, D. C., and Octave Chanute, of the Western Society of Engineers, at Chicago, distinguished scientists who have devoted much attention to aerostatics, to visit St. Louis for a conference upon the subject of the aerial tournament and aerostatic congress at the World's Fair. At this conference rules for the event will be determined and a proper division of the $200,000 will be decided upon. It is also probable that they will recommend for appointment a chief of the aerostatic display.

The announcement that such a liberal sum would be set aside for the encouragement of experiments in aerial navigation has stirred up a very lively interest in the science, and many inquiries have been received by mail and wire at Exposition headquarters. Secretary Stevens reports that it is probable there will be at least one hundred entries representing not less than ten countries.

VERDICT IN NEW YORK CENTRAL TUNNEL WRECK INQUEST.

The Coroner's jury, at the inquest into the deaths of the seventeen victims of the late disaster in the New York Central tunnel returned a verdict to the effect that the collision was due to the failure of the engineer of the Harlem train to stop his locomotive at the danger signal at Fifty-ninth Street, which was properly set. The verdict proceeds to say:

"We further find that the said engineer, John M. Wisker, owing to the heavy atmosphere, due to weather conditions, together with the presence of large bodies of steam and smoke escaping from trains passing on various tracks in said tunnel, obscuring said signal, was unable to locate said danger signal.

"We further find faulty management on the part of the officials of the New York Central and Hudson River Railroad, and we hold said officials responsible for the reason that during the past ten years said officials have been repeatedly warned by their locomotive engineers and other employés of the dangerous condition existing in said tunnel, imperiling the lives of thousands of passengers, and they have failed to remedy said conditions; and also for the reason that certain improvements in the way of both visible and audible signals could have been installed, and this disaster thereby have been avoided, and for the further reason that no regulation of speed at which trains should run in said tunnel has been enforced, thereby allowing engineers to exercise their own discretion."

The export of horses and mules from New Orleans to South Africa from October 1, 1899, to November 30, 1901, shows a total valuation of $13,483,052. This is exclusive of feed, which amounted in value to $992,618. The total number of horses and mules shipped is 143,050, of which 75,991 were horses.

A FIRE ALARM WHISTLE BLOWN BY GAS.

One of our correspondents, Mr. J. H. Ritchie, of Cherryvale, Kan., has sent us an interesting photograph of the fire alarm whistle used by the Pioneer Fire Company of that city. This whistle is blown by natural gas furnished by a local gas company. It is said to be the only one of its kind and can be heard several miles. One of the gas wells flows 13,000,000 cubic feet a day, and is now considered the strongest well in the Kansas gas field. Natural gas is also used for fuel, for lighting the city and is also the only fuel used by zinc smelters employing 300 hands and by two vitrified-brick plants.

FIRE ALARM WHISTLE OPERATED BY NATURAL GAS.

Fire on Shipboard.

Why water is not always used in extinguishing fire in a ship's hold is clear, says Fire and Water. While it can be used to great advantage in the case of fires in the open air, if it should be employed to put out a big fire in the hold of a vessel the sudden burst of steam so formed would be the parent of disastrous results. M. Diolis, a French maritime engineer, has recently suggested a new method of discovering and extinguishing a fire on shipboard, especially that arising from spontaneous combustion in the cargo. To give warning of fire, or of a rise of temperature that may lead to it, he would distribute through the cargo vertical metallic tubes. Into these tubes, from time to time, thermometers could be lowered to ascertain the temperature. His next step would be to place in the midst of the cargo a large cask containing lime and communicating by a small tube with the bridge. In case of fire in the hull, sulphuric acid is poured into the tube, and a violent production of carbonic acid gas takes place, which smothers all combustion.

LIFTING JACK FOR ELECTRIC CARS.

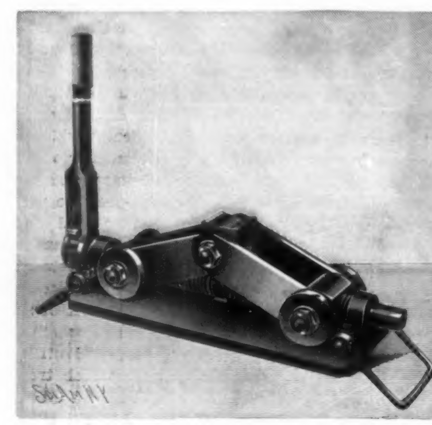
We illustrate herewith a lifting jack designed especially for electric car purposes, made under the patent of Mr. Golightly, and now being put on the market by Mr. George Addy, of Waverley Works, Sheffield. The arrangement is well shown by the engraving, from which it will be seen that by the combination of a toggle joint and a right and left-handed screw, worked by a ratchet lever, very great power is obtained in a compact form of apparatus and on moderate weight. The steel baseplate is 20 inches long and 8 inches wide, while the total height over all is 6½ inches. The weight complete is 96 pounds. The movement is vertical, there being no side thrust, and the motion when the jack is loaded is regular and well under control.

This appliance has been supplied, among other applications, to the Sheffield Corporation tramways, where it has been found to be admirably adapted for changing axle brasses on the road, for lifting trucks, to remove broken slipper-brake parts, sets, or other things. In one case of a broken axle it was found to be the best appliance for enabling a repair to be executed, as the jack gave a direct lift, so that every inch lifted was a clear gain. In the case of another jack placed under the platform, a movement of 10 inches is needed to lift 1 inch at the axle. It may be added that in the case of a fatal accident in Sheffield some time elapsed before the body of a man run down by a car could be released, there being no lifting jack on the car. In view of this the coroner's jury recommended that jacks should be placed on the cars, or should be provided at intervals along the road. In another case of a person being run over and getting under a car, the people in the street turned the car over to get the injured person free. This jack has also been adopted by the Bradford Corporation.—Engineering, London.

THE GREAT CLEARING YARD AT CHICAGO.

The greatest center of freight traffic in the world is found at Chicago, the meeting place of the eastern and western trunk lines. Here, every day of the year, there are handled about 10,000 cars of freight. Of this number over sixty per cent are cars loaded with through freight or cars which have entered the city by one railroad and will have to leave it by some other road. To transfer these 6,000 cars will mean, in the case of many of them, that they will have to be hauled over 15 miles from the incoming yard of one road to the outgoing yard of another, and that there will be a delay of a whole day in making the transfer. The other 4,000 cars are loaded with freight for Chicago. Under the system which has hitherto been followed in the transfer of this traffic, the trunk lines enter a terminal yard of the company, in which the freight trains are broken up, the cars sorted according to their destination, and outgoing trains made up. The inbound cars destined for an outgoing journey by other roads are taken by switch engines to the yards of these roads, or else they are distributed by means of belt lines which have been built especially to connect the terminal yards of the various railroads. Over half of the cars are transferred by the various roads themselves with their own engines, the remaining half being transferred by the belt lines.

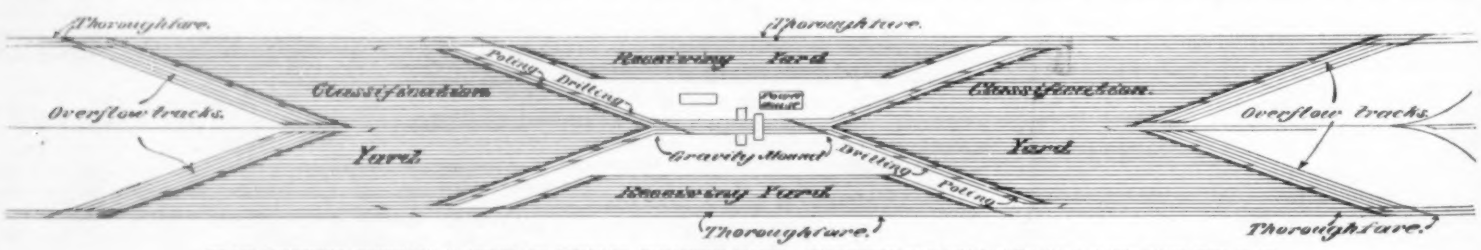
It can be understood that this work of transfer in-



LIFTING-JACK FOR ELECTRIC CARS.

volves much delay and labor, and it may often happen that a through car, reaching the yard shortly after the transfer train has left, will be delayed several hours before it can start out for the other road, or if the freight is specially important, a special trip has to be made for it. There are twenty trunk lines entering Chicago, and altogether the various belt lines and connecting lines have to operate a total of twenty-seven different yards. The distance between the yards varies from a tenth of a mile up to 16 miles, and it is estimated that the total number of cars interchanged daily averages over 7,000, while to haul them calls for the work of 264 engine round-trips. With these figures before him, the reader can readily understand that this system of independent operation of the yards causes endless complications and delays, involving in the aggregate a considerable expense to the railroads. The system which we illustrate in the accompanying engravings has been designed by A. W. Swanitz, C. E., for the Chicago Union Transfer Railway Company, for the purpose of overcoming the difficulties inherent in the present system of transfer and centralizing the work in one great clearing yard. This yard is located at a distance from the busy city lines, and the breaking up of trains and classification of them for their outgoing journeys will no longer be done separately by the various companies, but centrally.

The yard is located west of the city limits on a line with 67th Street. It extends east and west and connects with the Chicago and West Indiana Railroad on the east and with the Chicago Terminal Transfer Railroad and the Chicago Junction Railway on the west. It occupies a rectangular tract of ground 670 feet in width and 13,000 feet in length. The general arrangement of the yard is as follows: Ex-



PLAN SHOWING GENERAL LAYOUT OF CHICAGO CLEARING YARD. MAXIMUM CAPACITY OF YARD, 8,000 CARS PER DAY.

CHICAGO CLEARING YARD—LOOKING EAST FROM SIGNAL TOWER AT CENTER OF GRAVITY MOUND.

tending along the whole length of the north and south boundaries there are three thoroughfare tracks with double-track "Y" connections at each end to the belt lines. Bisecting the yard on an east and west line is a central through track known as "track No. 25." In the plan showing the general arrangement it will be seen that there are two sets of classification tracks, known as the "classification yards." The tracks in these yards are 2,400 feet long, and they extend the full width between the thoroughfare tracks. Midway between the two classification yards is an artificially-constructed gravity mound and on each side of it and parallel with it on the level plain are sets of receiving tracks which are from 1,600 to 3,200 feet in length. The gravity mound has an elevation at its summit of 21½ feet above the general level of the yard. For a short distance each side of the summit there is a grade of 1½ per cent, and then for a distance of 1,800 feet a grade of 0.9 per cent, which finishes in a grade of 0.5 per cent for a distance of 300 feet further, the foot of the gravity mound tracks being several hundred feet beyond the apex of the classification yards.

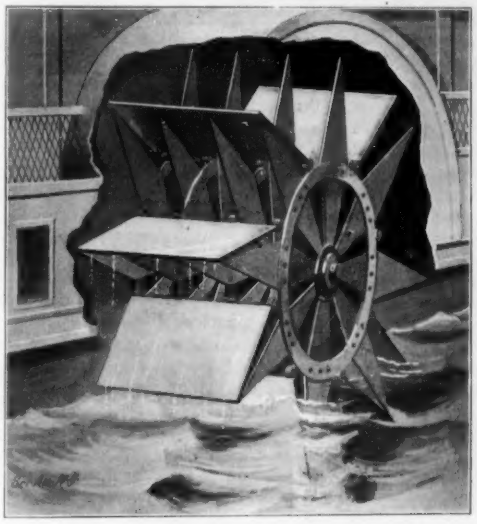
Running diagonally across the classification yards there are double ladders, and east and west of the classification tracks there are parallel overflow tracks which extend parallel with the classification ladders at the outer end of the classification yards. Parallel with the double ladder, at the inner ends of the classification tracks, are two tracks, the one next to the ladder being a "poling" and the outer one a "drilling" track. The double ladders, which connect by switches with each track in the classification yard, converge at a three-throw switch into the central track No. 25, already mentioned, which extends through the center of the whole yard. Consequently there extend over the summit of the gravity mound five parallel tracks with leader tracks and crossovers.

The object of the gravity mound is to allow the transfer of the cars to the various classification tracks to be accomplished by gravity and save a great amount of engine mileage which would be necessary if the cars had to be pushed onto the various tracks by switching engines. The method of operation is as follows: A train coming in at either end of the yard will be run into one of the receiving tracks, where the engine will be uncoupled and will take back a made-up train from one of the classification tracks, taking it out by means of the outer ladders of the classification tracks. One of the clearing yard switching engines will then couple onto the train, back up and push it over one of the drilling tracks, which we have mentioned above, as lying alongside the classification ladder. The drilling tracks and the whole V-point of the classification yard are on the grade of the gravity mound. As the train is pushed up to the summit, the couplers are disconnected at the proper places in the train, and as the cars go over onto the down-grade on the other side of the summit, they separate from the train and run down on the central track No. 25 to the three-throw switch at the apex of the classification ladder. Here they are switched to either side of the double ladder and finally into the desired track of the classification yard. Switching can be carried on simultaneously in both directions, that is, into both classification yards. The object of the "polling" track between each classification ladder and the drilling track is to allow an engine to assist the cars when a heavy wind is blowing against the grade or when there is snow upon the tracks.

The brakemen who ride on the cars down the gravity tracks are brought back by a light engine and car, which run to and fro either on the center track or on one or both of the tracks at the side of the classification tracks. The motive power of the yard will consist at first of six engines, four of them consolidations weighing 185,000 pounds and two of them six-wheeled switching engines weighing 120,000 pounds each. It is expected that from 5,000 to 8,000 cars can be switched and handled at this yard daily. For our illustrations and particulars we are indebted to A. W. Swanitz, chief engineer of the company.

A SELF-FEATHERING PADDLE-WHEEL.

The ordinary type of paddle-wheel encounters considerable resistance as it is submerged, and lifts no small quantity of water as it rises to the surface. As a result of these defects in construction, the engine must perform considerably more work than is actually required in propelling the ship. Mr. David W. Horton, of Petersburg, Ind., has designed a paddle-wheel which feathers itself both on entering and leaving the water,



THE HORTON PADDLE-WHEEL.

so that much of the power now unnecessarily expended is used in propelling the ship.

To the paddle-wheel shaft a series of parallel, radial, lozenge-shaped arms are secured. For the purpose of securing rigidity, a stay-ring is bolted to each circular series of arms at the widest part. Between the radial arms the paddle-blades are hinged to the stay-rings, in such a manner that they can be supported against the inclined face of either of the extending portions of the arms.

The paddle-wheels, as they successively pass the center of the wheel while it is rotating in either direction, will incline forwardly, and will thus be presented at or near a right angle to the surface of the water. The blade approaching the water will be submerged edgewise with a minimum of resistance. When fully immersed, the pressure of the paddle-blade and the immobility of the water when subjected to sudden impact, will rock the blade back until it impinges upon the arms immediately behind. The successive rearward movement of the blades will cause them to engage the water throughout their areas, when submerged, so that they will exert a maximum pressure. Each paddle-blade, by reason of its rearward inclination, will leave the water edgewise. Thus the paddle-blades are feathered while entering and leaving the water, and thus the tendency of ordinary wheels to lift a mass of water is prevented.

SCIENTIFIC METHODS OF MOVING TREES.

BY DAY ALLEN WILLEY.

The transferring of trees is at present so scientifically conducted that it is not necessary to wait ten or fifteen years for shade trees to grow for one's grounds or to ornament the landscape with large specimens of trees. In fact, parks and the surroundings of country seats can be made to order these days, the grounds about the residence being beautified and shaded while the home is being constructed. At a number of villages on Long Island can be seen fine specimens of forest growth ranging from twenty-five to fifty years old, moved various distances and replanted, yet are growing vigorously and to all appearances are in perfect health. They include such specimens as silver maple, Norway maple, beech, birch, linden, fir, hemlock and cherry.

Apparently it would seem impossible to transplant a tree fifty feet in height, with a trunk varying from one to two and one-half or three feet in diameter at the base, for even a novice realizes the extent of the roots which spread through a wide area of ground in all directions, yet the operation is being performed with complete success. What is known as a tree mover, the invention of Mr. Henry Hicks, of Westbury, N. Y., has been adapted for the purpose. In operating with this apparatus, the tree, if of 14 to 26 inches diameter of trunk, is dug by starting a circular trench with a diameter of 30 to 40 feet. An undercut is made beneath the roots with a light prospecting pick, and the soil picked out and caved down with a spading fork or picking rod, the points of which are rounded to avoid cutting off the roots. The lose dirt is shoveled out of the bottom of the trench and the roots are uncovered, tied in bundles with lath yarn and bent up, out of the way of the diggers. If the roots are to be out of the ground even for one day in dry weather, the bundles are wrapped in clay mud, damp moss and straw or burlap. When the digging has progressed within from 4 to 8 feet of the center, the tree is slightly tipped over to loosen the central ball, which cleaves from the subsoil near the extremities of the downward roots. On sand or hardpan subsoil this is at a depth of 2 to 5 feet. In deep soil it may be necessary to cut some downward roots. A ball of earth is left in the center from 5 to 12 feet in diameter, or as heavy as can be drawn by four to eight horses. This ball is not essential with deciduous trees, but it is easier to leave it than to remove and replace the soil. With fine-rooted trees like the red maple, it is difficult to pick out the soil, while with coarse-rooted trees, like the beech, in gravelly soil the ball drops to pieces.

In loading for removal, the cradle of the mover, which is pivoted above or back of the axle, is swung over to the tree, the trunk first being wrapped with cushions and slats. It is thus clamped to the cradle by chains and screws without injuring the bark. By means of a screw 9 feet long operated by a ratchet lever or hand-brake wheel, the cradle lifts the tree from the hole and swings it over in a horizontal position. Pulling in the same direction by tackle fastened in the top of the tree aids the work of the screw. After the tree is loaded, the roots on the other side of the axle are tied up to the perches. The front wheels are on pivots, therefore

ROOTS WITH 35-FOOT SPREAD BEING TRANSPLANTED AFTER BEING TIED TO BRANCHES.

LOWERING THE TREE INTO HOLE AFTER POLE AND SEAT ARE REMOVED.

the roots are not broken by the swinging of the axle. The roots are next drawn aside to put in the pole and driver's seat. Planks are placed under the wheels, and the mover is pulled out of the hole by tackle.

The hole to receive the tree is prepared with a layer of soft mud in the bottom, which partly fills the crevices between the roots as the tree is lowered into it. The weight of the tree is not allowed to rest upon and crush the downward roots, but is supported by the mover until fine earth is packed in. Soil is worked down between the center roots in the form of mud by means of a stream of water and packing sticks. The side roots are next unwrapped and covered at their natural depth. While the tree is horizontal, it is usually pruned, the outside being cut back 1 to 3 feet, cutting to a crotch or bud, and the remaining twigs thinned out about one-third. Hardwood trees and trees with few roots need the most severe pruning.

Until it is firmly embedded, the tree is secured by guy wires. Anchor posts are set slanting 4½ feet in the ground with a cross piece just below the surface. Two to six strands of galvanized steel wire are used, run from the posts through pieces of hose, around the tree and back to the post. It is twisted tight with two sticks turning in the same direction and moving toward each other. To prevent the sun from drying out the bark on the south side of the tree, the trunk is wrapped with straw, especially thin-barked trees, like beech and silver maple. By following the plan described, enough of the smaller roots of the tree are preserved to give it ample nourishment if it is transplanted in soil which contains fertilizing elements.

As already stated, Long Island contains a number of illustrations of landscape gardening which includes large trees transferred in this manner. The accompanying illustrations give an idea of some effects which have been produced. They depict various species which have been dug up, transferred on the movable vehicles a distance of from fifteen to twenty-five miles and reset. As will be noted, they have grown erect and in some cases more shapely than when in their original positions.

In spite of the details which accompany the work, a force of five or six men only is required to remove and set the largest trees, and the work can be accomplished in a comparatively short space of time. Consequently the owner of a plot of ground entirely destitute of trees can surround his residence with a grove of one hundred or more hardy specimens of the forest, arranged in artistic groups to suit his fancy, the operation representing but a few months from beginning to end.

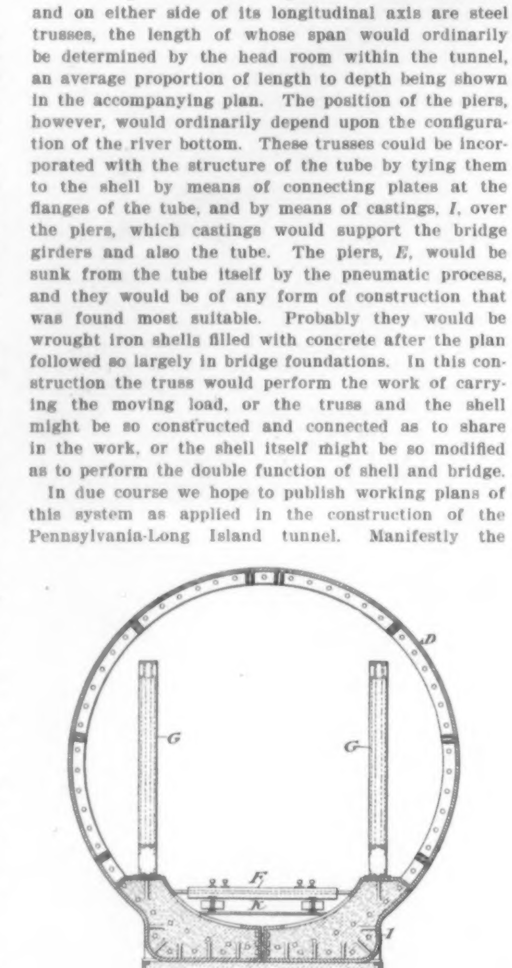
THE PENNSYLVANIA RAILROAD TUNNEL BRIDGE.

The accompanying illustrations are reproduced from the Patent Office drawings of the new system devised by Charles M. Jacobs, Consulting Engineer, for the construction of tunnels through silt and other loose material which is naturally ill-adapted to carry such structures. In driving tunnels through the ordinary run of material, such as solid rock, loose rock, cement, gravel or hardpan, it is sufficient either, as in the case of solid rock, to make an excavation larger than the gage required by traffic and line the excavation with masonry or concrete, or, as in the system so largely adopted in London tunnels, a metallic tube may be driven through the material. In case of any of the materials named, when once the tunnel is excavated, or the tube driven, the stability of the structure is assured for all time, as displacement, vertical or lateral, is impossible.

In driving tunnels beneath rivers where deep deposits of silt of varying consistency are encountered, it may happen that the silt is of such a semi-fluid consistency that when heavy traffic began to pass through the tunnel it would be in danger of throwing the tunnel out of alinement even to the extent of causing actual fracture of the same. The invention of Mr. Jacobs, while it was primarily designed to overcome the difficulties likely to be encountered in building the proposed tunnel beneath the North River, is, of course, applicable to tunneling operations under other rivers, or through swampy or saturated material, whose consistency is such as to threaten the permanence of the tunnel. In the case of the North River tunnel it would be possible, by carrying the tunnel to a sufficient depth below the river, to secure firm material, but this course would be open to the objection that it would involve heavier grades than are desirable for the economical and speedy operation of the line. Mr. Jacobs, therefore, determined to carry his tunnels at a higher elevation and overcome the objections due to the looseness of the upper strata of the river bottom, by giving his tubes sufficient transverse and lateral strength to perform the full functions of a bridge or girder, and support the bridge tube thus formed at stated intervals by means of piers carried down until they reach the underlying rock.

We present two illustrations, one showing a longitudinal view of the tunnel bridge, the other a cross-section. The tube may be built in the ordinary manner, of segments of cast iron, provided with internal flanges and bolted together. Within the tube and on either side of its longitudinal axis are steel trusses, the length of whose span would ordinarily be determined by the head room within the tunnel, an average proportion of length to depth being shown in the accompanying plan. The position of the piers, however, would ordinarily depend upon the configuration of the river bottom. These trusses could be incorporated with the structure of the tube by tying them to the shell by means of connecting plates at the flanges of the tube, and by means of castings, *I*, over the piers, which castings would support the bridge girders and also the tube. The piers, *E*, would be sunk from the tube itself by the pneumatic process, and they would be of any form of construction that was found most suitable. Probably they would be wrought iron shells filled with concrete after the plan followed so largely in bridge foundations. In this construction the truss would perform the work of carrying the moving load, or the truss and the shell might be so constructed and connected as to share in the work, or the shell itself might be so modified as to perform the double function of shell and bridge.

In due course we hope to publish working plans of this system as applied in the construction of the Pennsylvania-Long Island tunnel. Manifestly the most difficult problem will be the sinking of the piers; although we see no reason why this should not be satisfactorily and safely accomplished in spite of the very limited head-room available.



METHOD OF CONSTRUCTING BRIDGE TUNNELS UNDER THE HUDSON RIVER, AS PROPOSED BY CHARLES M. JACOBS FOR THE PENNSYLVANIA-LONG ISLAND TUNNELS.

The Current Supplement.

The current Supplement, No. 1,361, is begun by a most interesting article on Mexico, with eight illustrations. This is the first article of the series. In view of the Pan-American Congress which was held in the city of Mexico and the visit of the Mining Engineers to Mexico, this series will prove valuable. It is an abstract of a lecture delivered by Dr. W. P. Wilson, Director of the Philadelphia Commercial Museums. "Benzine Motor Cycle" describes in great detail one type of these interesting machines, and is accompanied by elaborate drawings. "Tubes with Sides and Without in Ship Resistance—An Example from Lord Kelvin" is by Marston Niles. "Behind the Wings in the Hoftheater in Dresden" describes how many novel stage effects are obtained.

Prof. Charles Wilson has announced to the Royal Society a new determination of the temperature of the sun, which, with due allowance for slight unavoidable errors, is placed at 6,200 degrees centigrade (11,192 Fahr.). If the probable absorption of the sun's radiated heat by its own atmosphere is allowed for, the mean temperature of the sun's body is placed at 6,600 degrees centigrade. Prof. Wilson started his calculations almost ten years ago.

Correspondence.

A Universal Language.

To the Editor of the Scientific American:

There will be a universal language, no doubt. It seems to be inevitable. It is also pretty certain that it will not be an artificial language. The failure of the attempts at language making *de novo* have been very conclusive on this point.

The next question is: What language will conquer the world? We may argue about this as we will. The fact remains that the English is *doing* this in a most convincing way. When other languages are brought in contact with English they fail to hold their own. It is common for foreign families in America to find themselves unable to make their children speak the language of the fatherland. This never happens with foreign-born children of English-speaking parents living abroad. The children hold the English with the foreign tongue, usually speaking both. The loss of the parents' native language by the children, in spite of most strenuous efforts, is a commonly known fact in America.

English is capable of stating facts and ideas more directly than other languages. This is constantly seen when newspapers and books are printed in several languages in parallel columns. English in nearly every case occupies the least space. The terse vigor of its every-day idioms makes it convenient and easy.

It can express every thought and every shade of emotion of the human mind that can be expressed in language. There may be words in other languages which some people think do not have equivalents in English, but the thought can be translated into English nevertheless. The thought is expressible.

For these reasons the English language is prevailing on its own merits. The growing power of the English-speaking peoples is another reason for its spreading use. This is aided by the fact that the peoples who speak English do not learn other languages with any facility.

One Who Speaks English Only.

Preventing Spontaneous Combustion of Coal.

A remedy has long been sought for preventing the spontaneous combustion of coal upon colliers and other vessels carrying large cargoes of coal, while at sea, but so far all the devices have proved futile. Coal always absorbs oxygen from the air, and always generates heat in consequence of the combination of the oxygen with the carbonaceous contents of the coal, and in the course of time spontaneous combustion ensues. Now, however, a system for preventing such conflagrations at sea has been invented by Mr. Thomas Clayton, of London, England. When the ship has been duly loaded, a quantity of sulphur dioxide gas is injected into the hold containing the coal. All possibility of an explosion or spontaneous combustion is thereby removed, and the hatches may be securely battened down. Some interesting experiments have been carried out to prove the practicability and efficiency of this invention. A chamber was filled with about 6 per cent of sulphur dioxide gas. A lighted torch was then thrust into it and was instantly extinguished. A long lighted torch was then slowly inserted in the chamber, and as it came into contact with the gas the fire was extinguished. A broad red-hot bar of iron was next inserted in the chamber, and a torch composed of straw dipped in naphtha was then placed upon the iron, but neither the naphtha nor the straw ignited. A broad red-hot bar of iron was inserted in the chamber and thrust into a bucket of naphtha. No explosion occurred. In fact, the result was similar to that achieved by plunging a red-hot iron into a bucket of water.

Hundredth Anniversary of Coal in America.

Arrangements were completed at Wilkesbarre on January 23 for the celebration of a notable anniversary, the one hundredth, of the burning of coal in this country, says the New York Tribune. This took place at the old Fell House, the experiment being conducted by Jesse Fell on February 11, 1802, and was witnessed by all the prominent men in town, word having been received from Mauch Chunk that the "black rock," so plentiful in the region, would burn and give heat. The occasion was made an important event, and the anniversary will be no less so. The old grate is still in existence, although it was twice stolen, once at the close of the Philadelphia Centennial, and again a short time later, and it is now in the same spot where it first held the glowing coal.

The artesian well at Grenelle, Paris, took ten years of continuous work before water was struck, at a depth of 1,780 feet, says The Engineer. At 1,259 feet over 200 feet of boring-rod broke and fell into the well and it was fifteen months before it was recovered. A flow of 900,000 gallons per day is obtained from it, the bore being 8 inches.

WORK OF THE ISTHMIAN CANAL ENGINEERS.

BY FREDERICK MOORE.

The work of the Isthmian Canal Commission's surveyors, hydrographers, geographers, geologists, topographers and other assistants has resulted, at last, in definite printed material voluminous in the extreme and of value in proportion to its abundance. All these maps, diagrams, etc., fresh from the press, mean a work in which many engineers would be proud to have taken a hand.

A chief engineer was appointed for the report on each of the canal routes to which the commission was directed to give special attention. He was directed to make his headquarters in his respective territory and to take general control of the field operations therein. Considering the results of the numerous surveys made in the past, it was decided by the commission to limit the explorations in search for "other possible routes," as Congress directed, to that part of Colombia known as the Darien country, lying between Panama and the Atrato River; and a third engineer was appointed to direct the field work there.

Competent assistants, whose education and experience had fitted them for the special work to be done, were assigned to service under the three chief engineers; and laborers, boatmen and other workmen were hired wherever their services were required. Twenty working parties were organized in Nicaragua, including 159 engineers and assistants and 455 laborers. Five parties were organized in Panama, with 20 engineers and assistants and 41 laborers. And six parties were sent to the Darien, numbering 54 engineers and 112 laborers.

The chief engineers were directed to examine with the aid of these working parties the geography, hydrology, topography and other physical features of the different countries. The schemes already planned were thoroughly tested, and further surveys were made in order to vary the line and select better locations wherever the conditions were found to be unsatisfactory. Accordingly, a complete project was prepared for each route, and the center line of each canal was marked where that had not already been done.

The study involved examinations of the terminal harbors and approaches, the locations selected for dams, locks, embankments and other auxiliary works. Borings to determine the nature of the subsurface materials at the sites of the locks and along the canal lines, and observations of rainfall, stream flow, sedimental deposits, and lake and ocean fluctuations, were, in the main, the work to be done. Attention was also given to the supplies of rock, timber and other materials on the canal lines available for construction and maintenance.

The results of these examinations and observations, and the material and data obtained, were sent from time to time to the headquarters of the commission at Washington, where they were arranged and entered upon plates and profiles under the direction of the committees of the commission in charge of the respective canal surveys. How the engineers did the work is interesting, and their life in the Isthmus, indeed, an experience.

Each of the parties was allotted a certain territory. They would establish a camp along the approximate routes, living in tents, huts of palm leaves, or, if near a village, in some "hotel" therein. From these they would work from three to five miles in each direction, and then pack bag and baggage and grub by mule or canoe or other conveyance to a new camp; and so on till they met the next party or the next party's work.

The largest force was placed on the Nicaraguan line because it was the longest, because the many reports on the line were at variance, and because the data obtainable from the Maritime Canal Company was found to be of little value owing to its inaccuracy, age and the fact that the company's designs were for a canal that, for its shallowness, would be useless to-day. The number of authentic surveys that have been made on the Panama line (especially that of the International Commission of engineers) and the full and sufficient data the Panama Company holds, made a large force there unnecessary. The Darien line was foredoomed, but in compliance with the bill authorizing the investigations of other possible routes, a fair survey of it had to be made.

The method of observing the regimen and discharge of the streams was simple. A stout line was stretched from bank to bank, or from trees on the banks. Below was placed a windlass to haul out the trolley car in which the gagers rode. Of course, a point was selected as near as possible to the location at which knowledge was desired, having reference to the conditions of the stream itself, the aim being to secure high and permanent banks on both sides, as straight a channel with as uniform a depth and velocity as could be found and avoiding any location which was a short distance above any tributary of importance which might create back water. A gage graduated to feet and tenths was placed in the stream near one bank and so situated as to be conveniently read from the shore. It was usually possible to fasten such a gage in a vertical position in deep water to the trunk of an overhanging tree (for they grow over the banks and even in the streams in Central America). The height was recorded twice a day, and the mean of the two gages taken as the river's height for that day. At various intervals, depending on the change of the gage, measurements of discharge were made from the trolley cars with current meters. Soundings were taken at a known distance from an assumed initial point, and the velocity measured by submerging an electric current meter at six-tenths of the measured depth and holding it in that position for a length of time—usually 100 seconds or more—sufficient to make a good determination of the velocity at that point. This operation was repeated at short intervals for the width of the stream, and from them the discharge of cubic feet per second was computed for each section by multiplying the depth, width and measured velocity together. The discharge of the several sections added together gives the result for the stream. At the beginning and end of staging a careful note was made of the gage and the mean depth of water taken.

Every other detail of the work was done in the same simple and thorough manner. Lake Nicaragua's every tributary was gaged and its supply accurately determined; for the control of the waters of the lake is vital to the practical operation of a canal, and has an important bearing on the cost and plans of the project. It fluctuates now some 12 feet, which would materially hamper lock workings, hence the careful observations of the fluctuations, the maximum and minimum inflow and outflow and the evaporation. Because of violent breakers on the lake the gages had to be protected behind old vessels or whatever was found along the coast. At Las Lagas the boiler of a wrecked vessel was used to incase the gages and evaporating pans.

Observations of rainfall were made with a funnel and a bottle, the relations of the diameter of the funnel mouth to that of the bottle being accurately known. The rainfall is a remarkable characteristic of Central America, and particularly Nicaragua. There is a radical and striking difference between the falls on the eastern and western coast. There is a definite dry season on one, but rain may be expected the year around on the other. At Brito there is practically no rainfall from January to the middle of May, but during the rainy season the downpour often reaches 5.6 inches per day.

The evaporation test did not work as well, usually, as the others. Galvanized sheet iron pans, 3 feet square and 2 feet deep, were anchored in some protected body of water alongside a rain gage, giving the water in them the same freedom, as far as practicable, as the outside water had. But the waves would wash over and fill them, the natives would steal them or haul them ashore and make washtubs out of them, and animals would overturn them.

The same windlass that trolleyed the cars across the rivers was used to tow out the sediment gage cars. These too, were galvanized pans, one meter square and 8 inches deep. The upstream side was on a hinge. The pan was lowered into the streams and anchored. When the time came to haul it up, the gate was closed by a copper wire and the windlass put to work. First it was hoisted gently out of the water, then trolleyed to shore. The silt deposit is an all-important test and has much influence on the location of the locks. Samples were also taken of the waters and allowed to settle ashore, each day the clear water behind drained off and more muddy water poured on.

The measurements were made with 100-foot steel chains, they being checked each fortnight by comparison with steel tapes. All angles were measured carefully with a transit, deduced bearings being carried through as a check to the reading of the angles. The density of the forests and the incessant heavy rains or cloudiness materially inconvenienced the reading of the instruments. Special care was taken in chaining, plumb bobs being used on all broken ground. Elevations of surface were taken with a wye level and target rod at intervals of 100 feet, and at such intermediate points as were necessary in order to produce close and accurate profiles.

These are but a few of the innumerable tests that were made, but they go to demonstrate that dependence may be placed on the commission's report. For those among the parties who loved hunting big game and fishing there was some relief from the work, but their hardships were sometimes excessive. The food was sometimes worse than they had ever before experienced, even in the wildest places in this country, the density of vegetation hampered their work, all the labor was inefficient (this will be a serious question when the canal comes to be built), the prevalence of the "pica-pica" plant, bearing a pod which sheds a dry, irritating dust, was almost unendurable, and the extraordinary number of wasp nests was extremely harrassing.

The engineers generally say they are glad to have had their names coupled with the canal work, but they want no more of it.

THE HEAVENS IN FEBRUARY.

BY HENRY NORRIS RUSSELL, PH D.

The planetary displays, to which we have been treated for many months, come at last to an end about the middle of February, when Venus and Mercury pass together from the evening skies, and for some time only the fixed stars greet the sight. If, however, we were as well accustomed to view the skies before dawn as after sunset, we might say that the display was just beginning, for the southeastern heavens before sunrise are then enriched by the presence of several planets. But, for most of us, our interest must for a time be confined to the unchanging constellations, which in themselves are a splendid sight in the clear air of a winter night.

The following description holds good for the hour of 10 P. M. at the beginning of the month, and of 8 P. M. at its close.

The finest part of the sky lies along the meridian, and to the west of it. Gemini is nearly overhead, a little south of the zenith. Canis Minor lies below, and Canis Major still lower, extending nearly to the southern horizon. Auriga is northwest of the zenith, and Taurus west of it, the Pleiades being the lowest part of the constellation. Orion lies to the southward, with Eridanus below on the right. Aries is well down in the west, with Cetus setting below it. Perseus, Cassiopeia, and Andromeda are in the northwest. Cepheus and Ursa Minor lie below the Pole, and Ursa Major above it on the right. Leo is well up in the east, and part of Virgo is rising. About half of Hydra may be seen in the southeast.

Below Sirius to the left, low down on the horizon, is part of the great constellation Argo. Its brightest star, Canopus, which stands next to Sirius in brilliancy, is too far south to be seen from New York.

The pole is 41 deg. below the horizon of New York. Hence Canopus, even when it is directly above the pole, is 41 deg. to 37½ deg., or 3½ deg. below the horizon, and consequently invisible.

THE PLANETS.

Mercury is evening star at the beginning of the month, setting an hour and a half after the sun. On the 2d he reaches his greatest elongation, and is favorably placed for observation, being north of the sun, and unusually bright. After this date he rapidly approaches the sun, passing north of him, at an apparent distance of about 4 deg., and becoming a morning star. On the 28th he rises nearly an hour before sunrise, and is again visible to the unaided eye.

Venus passes through much the same phases. On the 1st she is evening star, setting at about 7 P. M. She moves rapidly toward the sun, so that she sets about six minutes earlier each evening. By the 10th she is above the horizon only half an hour after sunset, and on the 14th she reaches her inferior conjunction, passing between us and the sun, but so far out of line that she appears to be some 8 deg. north of him. She is then only one-tenth as bright as she was in January, but is still nearly equal to Jupiter. After this she moves out to the west of the sun, becoming a morning star and growing brighter. At the end of the month she rises one and a half hours earlier than the sun and is conspicuous in the morning skies.

All through the month she is very near the earth, their distance being 28,000,000 miles on the 1st, which decreases to 25,500,000 miles on the 15th and then increases again to 28,000,000 on the 28th. This is nearer than any other heavenly body ever comes, except the moon, the little asteroid Eros, and occasionally a stray comet.

Of the other planets there is little to say. Mars is still evening star, but is too near the sun to be seen. Jupiter and Saturn are morning stars, rising some two hours before the sun on the 15th. Uranus is in Ophiuchus and rises about 3 A. M. Neptune is in Gemini and visible in the evening.

THE MOON.

New moon occurs on the morning of the 8th, first quarter on that of the 15th, and full moon on that of the 22d. The ensuing phase falls in March. The moon is nearest on the 16th, and farthest away on the 1st. She is in conjunction with Uranus on the 3d, Saturn and Jupiter on the 6th, Venus on the night of the 8th, Mars and Mercury on the following day, and Neptune on the 17th.

On the morning of the 26th the moon passes in front of the bright star Spica, in the constellation Virgo, hiding it for over an hour. As seen from Washington the star disappears behind the moon at about 3:30 A. M. and reappears at about 4:40.

A speed of 105 miles per hour has been attained on the Zossen experimental electric railway. The main tests are to be at a speed of 125 miles per hour.

SOME TREES AND FORESTS OF CALIFORNIA.

BY CHARLES F. HOLDER.

An interesting movement is on foot in Southern California, namely, the reforesting of the Sierra Madre. For many years during the white regime and many more under the Indians, the fine range known as the Sierra Madre, the coast range of Southern California, has been burned over and devastated. During the past ten years forest fires have raged in the San Gabriel Valley and burned many square miles of territory contiguous to Pasadena and Los Angeles, seemingly threatening the water supply of this region. That something must be done, if the flora of the mountains was to be saved, was evident, but little progress was made until Mr. T. P. Lukens, ex-mayor of Pasadena, a lover of nature, undertook the work. At first, single-handed and alone, he began experimenting with the best trees, and now as a result, he has planted tens of thousands of pines (*Pinus tuberculata*) on the slopes of the Sierra Madre in Southern California, especially along the line of the valleys beginning with the San Gabriel.

THE CREEPING OAK NEAR MONTEREY, CAL., COVERING 12,500 FEET OF GROUND.

Mr. Lukens has met with great success, and in a few years the result of his labors will be visible from a distance and the water supply will be greatly increased.

The trees and forests of California are extremely interesting, and in their study or observation one is often impressed by their sensitiveness to various factors for or against a fine development.

Trees are susceptible to many influences. Near Monterey is found the remarkable oak shown in the accompanying illustration and locally pointed out as a "curiosity" as the creeping oak. The tree has made an extraordinary growth in former times, and appears to have been depressed by the winds until its many branches reach out from the trunk and appear to be creeping along the ground, while other branches fill the air above them, presenting an appearance difficult to describe, but resembling a mass of snakes more than anything else. The tree covers an acre, or 12,500 feet of ground, and has resisted for many years the raids of vandal wood choppers who covet the mass of timber.

Aside from the oak groves the real forests of California are found in the mountains. The redwoods of the Coast Range are magnified specimens. In former years, fifty years ago, there were giants within five miles of the city of San Francisco that would to-day be of inestimable value; but the sawmill was among the pioneers, and the giant redwoods were destroyed, there being no vigilantes to save or revenge them. The writer saw the trunk of one of these giants in Mill Valley which had been leveled off near the ground and was used as a dance platform. Another was a bower or hall for other purposes. The young shoots had grown up around the edge of the trunk, telling the story of its size. The redwood forests of the California Coast Range are its chief glory, but they are being devastated with a ruthless hand.

In the Sierras the giant sequoias, cousins of the redwood, are preserved, and here are many pines, among the most beautiful of California forest trees. Typical trees are the madrona and suazatteta. In Northern California the latter are found near the sea, low down, but in the south they affect the higher levels.

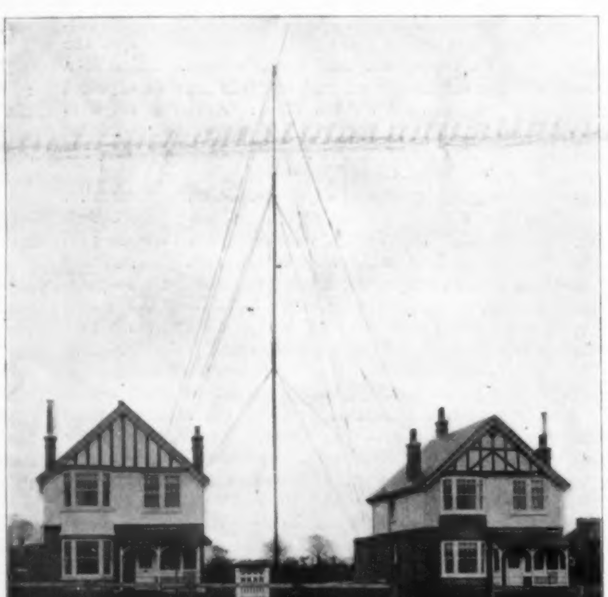
THE MARCONI SCHOOL OF WIRELESS TELEGRAPHY.

BY E. J. SHEPSTONE.

The Marconi Wireless Telegraph Company, of London, England, have opened, at Frinton-on-Sea, in Essex, a school for the teaching of wireless telegraphy, the only institution of its kind in Great Britain, if not in the world. Hitherto the company have trained their men at their works in Chelmsford, Essex, but the demand for competent operators has been so great that the company decided some three or four months ago to open a college for tuition in the Marconi system of telegraphy.

The Institution is unique in that pupils are paid a small premium to attend, although, as Major Flood Page, managing director to the company, explained to the writer, this system will not endure. Only those who have passed through technical schools or show an aptitude for such work are admitted.

The school really consists of two villa residences, the only exterior indication that it is a telegraph college being its tall pole. It is a very conspicuous feature on the landscape, being no less than 165 feet in height. It is erected in the center of the garden, and made firm by a number of wire cables. At the time of the writer's visit to the school the students numbered six, in charge of the principal, Mr. T. Bowden, undoubtedly a very clever telegraphist and electrician. He spent a great deal of time with the famous inventor at his experimental laboratory at Poole, on the English south coast, and has also traveled with Mr. Marconi nearly all over the world, conducting experiments and erecting stations.

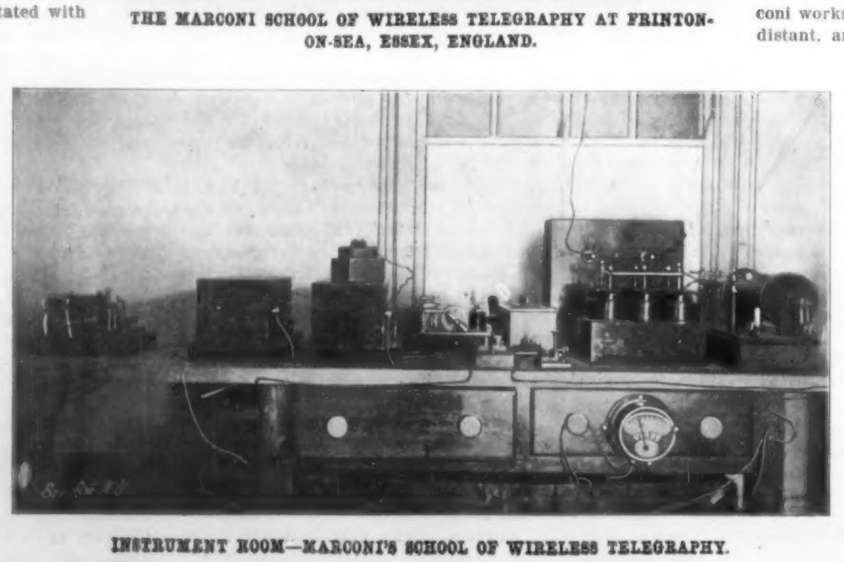


THE MARCONI SCHOOL OF WIRELESS TELEGRAPHY AT FRINTON-ON-SEA, ESSEX, ENGLAND.

The object of the school is not only to teach the would-be operator how to send and receive messages, but also to impart a technical knowledge of the instruments used. Indeed, after passing a course of instruction at the school, the student would not only be capable of taking entire charge of an instrument on board a vessel, but of working and equipping a station anywhere. As all messages are sent by the Morse key, the first thing the pupil has to do is to learn the new alphabet; and the first week is invariably spent in learning Morse until he can read and write it just as well as he can his conventional alphabet.

Then follows a course of instruction in the various instruments, their object and mechanism being fully explained. The pupils are also taught how to repair machines, make new parts, and keep them in proper working order. The pupil is expected to be thoroughly acquainted with the system in the course of a month, though some remain in the school for a period of eight weeks. By that time they would be fully competent to go abroad and build stations on their own initiative in distant parts of the world. After a scholar has thoroughly mastered the new alphabet and the technique of the instruments he is put in charge of the Frinton station, and while in that capacity is absolutely responsible for all messages received and answered. He has also to make out a daily report to the London office and reply to all inquiries. Work commences at 9 o'clock and continues until 5:30 in the afternoon.

The instrument-room proper is in one of the kitchens of the villas, which has been considerably altered to accommodate the various instruments. It is unnecessary here to give a technical account of the apparatus, as the Marconi instruments have been fully described in this paper. It will be seen from an inspection of our photograph that the pole has two spars. From the lower one communication is enjoyed with the company's station at North Foreland, forty miles distant across the North Sea, with a tuned receiver. The writer kept up a conversation for nearly half an hour with the staff at North Foreland, all the dispatches being instantly acknowledged and answered. From the higher spar messages may be sent to the station at La Panne, on the Belgian coast, a distance of eighty miles as the crow flies, right across the North Sea. The company find the Frinton station very useful for testing their instruments before finally placing them on the vessels or dispatching them abroad. The Marconi works at Chelmsford are only twenty miles distant, and after completion the instruments are sent down to Frinton by rail and tested between these two points.



INSTRUMENT ROOM—MARCONI'S SCHOOL OF WIRELESS TELEGRAPHY.

As already stated, the college consists of two houses, the upper portions of which are used as bedrooms. All students are required to sleep at the institution. The company make them as comfortable as possible. There is a spacious dining-room, while the pupils have a parlor to themselves, equipped with a piano and quite a small library of technical books. There is also a small laboratory.

What has astonished English people most is the marvelous amount of work Mr. Marconi has accomplished within the past five years. He landed in England in 1896, with a unique set of instruments which were

destroyed by the Custom House authorities, who took them for bombs and infernal machines. Toward the end of that year he took out his first patent. During 1897 and 1898 he made wonderful strides in increasing the distances to which messages could be sent and received, and in March, 1899, succeeded in telegraphing without wires between France and England. On July 20, 1897, he floated the Marconi Wireless Telegraph Company, and in April, 1900, the Marconi International Marine Company, while to-day no fewer than forty-five ships of the British navy have been equipped with the Marconi apparatus, as well as all Lloyd's signaling stations and many of the lightships around the British coast.

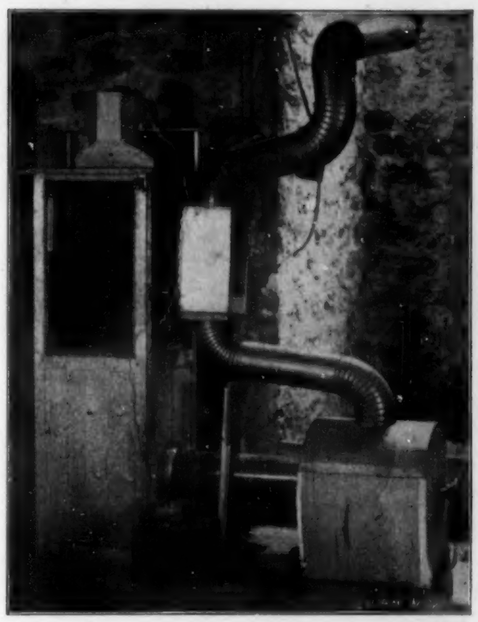
THE EXPERIMENTAL STUDY OF THE MOTION OF FLUIDS.

BY OUR PARIS CORRESPONDENT.

Mathematicians have developed certain interesting theories to explain the movement of a fluid in encountering obstacles. Unfortunately the results of such theoretical calculations have been of little value, because they were not based upon sufficient data obtained by actual observation, or because they applied only to non-existent perfect fluids, the molecules of which glide over each other without friction. If these mathematical theories could be verified experimentally much would be done both for hydrodynamics and aerial dynamics. Furthermore, it would be possible to devise a body which would encounter the least possible resistance in moving through water or air; for the laws underlying the movement of bodies around a stationary obstacle would apply conversely to a body moving through a fluid.

The first attempts to observe the movements of fluids directly by the eye, or indirectly by means of photography, were made some years ago by L. Mach. In these classic experiments of his, the warm and cold air was admitted into an observation chamber by way of numerous small openings. The threads of air streaming through these openings continued their movement in the observation chamber without intermingling. Although the eye could see nothing of this phenomenon, the photographic plate showed that differently heated currents did not mingle; for it is a well-known fact that light does not travel with the same speed in cold and warm air. Still another method of studying the current lines of fluids was adopted by an English physicist, Hele-Shaw. In 1897 he began to study the motion of water circling between the two parallel glass walls of a vessel and encountering various obstacles. Accidentally he found that a mixture of air and water, by reason of the division of the air into a number of globules, rendered it possible to follow the motion of the water with considerable accuracy. Photographs showed not only the places where vortices were produced by reason of the obstacles, but also proved the general law that in all cases, despite the violence of the current, the water is held to the obstacle by adhesion. The varying thickness of the layer thus retained furnishes a means for ascertaining to what extent the entire mass of water is affected by friction.

In order to study the movements of fluids, Hele-Shaw devised the apparatus shown in one of the accompanying engravings. The fluid, the movement of which he examines, is held in a glass box-like receptacle in a suitable stand. Water is allowed to enter the receptacle through a series of fine openings; and colored glycerine is pumped into the receptacle through another series of fine openings alternating with the first. A photographic camera is placed on one side of the stand, and a powerful source of light on the other.

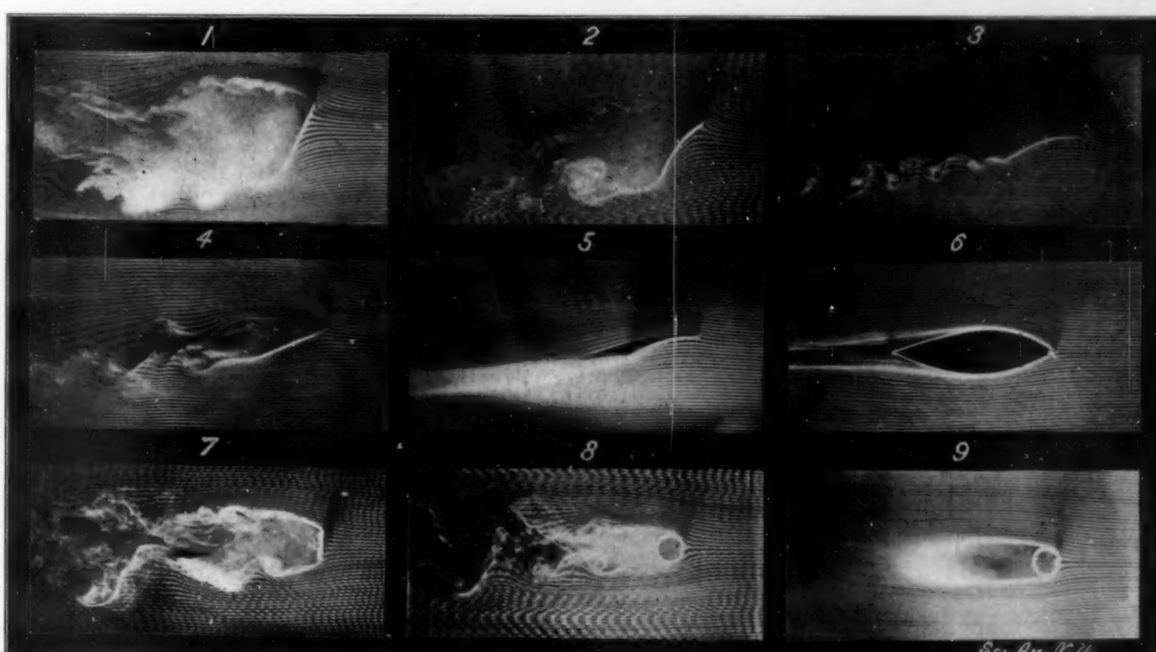


M. MAREY'S APPARATUS FOR STUDYING AIR CURRENTS.

By means of this apparatus Hele-Shaw was enabled to produce photographs corresponding exactly with the theoretical forms of current lines for fluids moving in narrow passages, pictured in Lamb's "Hydrodynamics." This mechanical method, however, is defective in so far as it shows only the direction of movement, and not the velocity at various obstacles.

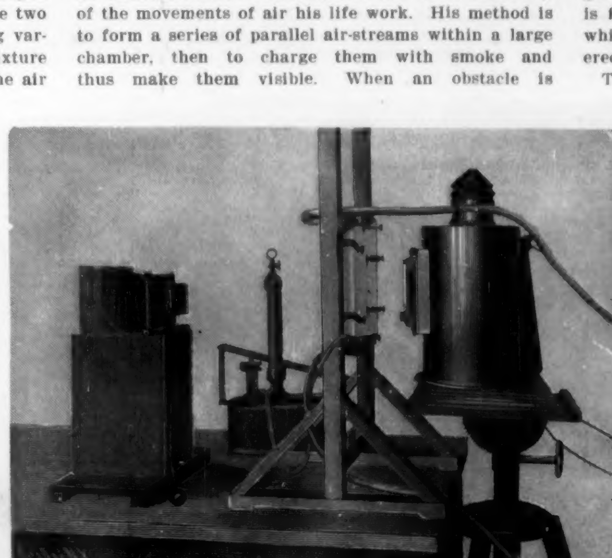
More accurate results have been obtained by Marey, an eminent French scientist, who has made the study of the movements of air his life work. His method is to form a series of parallel air-streams within a large chamber, then to charge them with smoke and thus make them visible. When an obstacle is placed in their path the movement of the air is clearly distinguished. To carry this out he uses the large chamber seen on the left of the engraving, 5 feet high and 2 feet in section. In the lower part is an orifice which is joined to the aspirating ventilator on the right, driven by a small electric motor. The air descends through an opening at the top of the chamber, which has stretched across it a frame covered with silk gauze whose meshes are very fine and regular. This serves to direct the air in a series of vertical streams and prevent the formation of vortices, and it thus descends parallel to the walls of the chamber. The smoke is fed into the air by a series of 60 tubes, ¼ inch in diameter and about the same distance apart. Back of the tubes is a small chamber in which the smoke-producing substance is burned, and the streams of smoke thus formed are easily observed and photographed. For this a glass-covered box in which magnesium is burned is placed in the path of the ventilating pipe as seen on the left and near the opening of the main chamber. An instantaneous flash is the best for showing the agitation of the air in the rear of an obstacle, while a prolonged exposure gives the resultant of different movements.

When the ventilator is set in motion the air is aspirated and draws with it the smoke, and the latter descends in a series of vertical cords which may reach as long as three feet if the air of the room is perfectly still. This is not always easy to realize, as often the movements of the operator are sufficient to cause a perceptible deflection of the air-currents. It only remains to interpose in the path of the air the obstacle whose influence is to be studied; this is fixed by very light supports placed against the rear wall. This wall is covered with black velvet so that the smoke-streams, when lighted by the magnesium, are observed as a brilliant white against a black background, and can be easily photographed. M. Marey has devised a very ingenious method of measuring the speed of each stream at different points of its path, and especially in front and in the rear of the obstacle. The smoke-tubes are connected with an electric vibrator whose period is generally regulated at 10 vibrations per second. In this way the smoke-streams assume a wave form which will be noticed on some of the figures. The distance apart of the waves gives a measure of the speed at each point. In the parts where the speed is slower the waves are closer together and *vice versa*. On the wall of the chamber is fixed a rod 8 inches long, parallel to the streams, which serves as a scale to measure the distance covered by the streams in each tenth of a second.



PHOTOGRAPHS OF THE AIR STREAMS UNDER VARYING CONDITIONS.

The accompanying figures show some of the most interesting results obtained by this method. In Fig. 1 the air encounters a plane surface inclined at about 70 degrees. It will be observed how the air-streams pass around the obstacle. Part of them mount on the left side, but the greater number follow the slope. In the rear is a region of agitated air which extends far back. The waves are closer together at the contact of the plane, showing a diminution of speed in Fig. 2, which represents a concave surface at an angle of about 45 deg. In Figs. 3 and 4 are shown the different manner in which the air acts in contact with concave and plane surfaces; the figures indicate that concave surfaces are more advantageous than plane surfaces as regards flying, a result which has been already proven by the aviators. In fact, in the rear of the concave surface the air is aspirated with energy and without much agitation, which is a very favorable condition, as this agitation represents a great expenditure of work. Fig. 5 is the same as Fig. 3, but with a different lighting; the former,



HELE-SHAW'S APPARATUS FOR PHOTOGRAPHING MOVING FLUIDS.

taken by an instantaneous flash, shows the agitated zone at a given moment; in the latter the light was continuous for several seconds, and gives the mean direction of the air. Here the agitated portion is represented by a white band. Fig. 6 is of especial interest as showing the resistance to the air which is offered by a body having the form of a boat or again of a dirigible balloon. In Figs. 7 and 8, two bodies, a plane and a cylinder having the same section, are compared in order to show how the streams curve in the rear of the obstacle and also the relative diminution of speed. Fig. 9 shows the same cylinder with a prolonged lighting, and here the zone of air in the rear of the cylinder is strikingly brought out.

As will be seen, the method of M. Marey is of great practical value in the study of the resistance which various bodies present to the air. It can be applied to great advantage in studying the best forms to be given to dirigible balloons. In the study of curved or plane surfaces it shows that the former are much more advantageous than the latter. The apparatus will also be useful to mathematicians in giving them figures which will facilitate the study of the laws of air-resistance.

Barium: Its Preparation and Properties.

In a paper lately read before the Académie des Sciences, M. Guntz describes an interesting series of experiments in which he obtains the metal barium in a pure state by a special method of electric heating. It seems that pure barium has not been as yet obtained. Bunsen, Frey and others of the older chemists indicate that they have obtained the metal, but more recently others such as Limbs, of Paris, and Lengyel, of Germany, have been unable to obtain it in a pure state, and therefore its properties are but little known. The author uses a barium chloride solution, using a mercury cathode. The mercury is then driven off in an electric heating device. A porcelain tube is placed within an outer tube of refractory earth and the latter is surrounded by a coil of platinum wire through which the current passes. The iron vessel containing the amalgam is placed in the porcelain tube and the whole is heated very gradually by the current. The amalgam continues to lose mercury, and at about 850 deg. C. it contains 90 per cent of barium. The mercury seems to be completely driven off at 1,000 deg. If raised to 1,150 deg. the metal is seen to boil and vaporizes very rapidly. Contrary to Frey, barium is melted below 1,000 deg. C., and its solidifying point is even much lower. It is a very volatile body, and this property explains why it has not been obtained heretofore by heating its amalgam. To remove it from the iron vessel, to which it adheres strongly, it must be cut out and thus oxidizes somewhat. This explains the rather low percentage, 98, which the author finds on analysis. The barium thus obtained is quite free from mercury, and has a metallic luster of a silver-white appearance when freshly cut. It is almost as soft as lead when quite free from mercury, but in the contrary case it is brittle. It is fusible at a low red heat and very volatile at a bright red. Thus if a fragment of barium is thrown into a bath of melted chloride of barium at a red heat it is seen to descend in the liquid, then to vaporize, and greenish flames coming from the combustion of the metal are produced at the surface. Barium oxidizes rapidly in the air, giving baryta. It often takes fire on contact with air, and almost always when it is detached from the mass by a hard body. Like lithium and calcium, it gives with liquefied ammonia gas an ammonium compound of a golden yellow color, which is quite soluble in the liquefied gas, but is a rather unstable body.

The Pennsylvania Railroad system has placed orders with three car manufacturing companies for freight cars, the order amounting in value to about $10,000,000. It is understood that the company intends to obviate for several years the likelihood of a car shortage like the present one. The Pressed Steel Car Company has received an order for 9,000 of the 15,000 cars. Two thousand cars will be built by the Cambria Steel Company, controlled by the Pennsylvania Railroad Company, and 1,000 will be built by the American Car and Foundry Company. The order for the remaining 3,000 cars has not yet been placed. Five thousand of the cars ordered from the Pressed Steel Car Company will be hopper cars for the transportation of coal. The railroad company has now in commission on main line and branches 150,000 freight cars.

MODELING IN BEACH SAND.

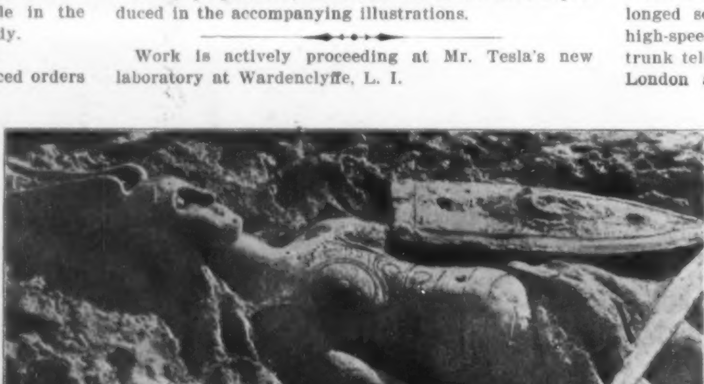
According to the Illustrirte Zeitung, Eugen Boermel, a well-known sculptor of Berlin, created something of a sensation last summer in the little seaside resort of Nordeney. The sculptor modeled in the sand of the beach a number of figures which have aroused the admiration of the hotel habitués. It is difficult enough to infuse life into dead marble; and it may, indeed, be considered still more difficult, from a technical standpoint, to give shape to so refractory a medium as crumbling sand.

MOTHER AND CHILD.

Two years ago Boermel made a few experiments along the shores of the Baltic in order to determine the practicability of the use of white beach sand for modeling. The experience which he gathered in these early endeavors culminated in his Nordeney work. He was primarily actuated by charitable considerations; for he was interested in a plan for providing for the family of a fisherman who had lost his life. Surrounded by a crowd of curious and admiring spectators, Boermel modeled, without any design and without any preparation, the forms which we have reproduced in the accompanying illustrations.

ÆGIR AND SACRIFICIAL OFFERING.

Work is actively proceeding at Mr. Tesla's new laboratory at Wardenclyffe, L. I.



BRUNHILDE.

Painting the Forth Bridge.

According to the Mechanical Engineer, the Forth bridge is now in process of receiving its fourth coat of paint since it was erected. Ever since the bridge was opened—11 years ago—the painting process has gone on continuously. Beginning at the south end, the workmen take three years to cover the entire length of the bridge, and, as three years represents approximately the life of the paint, no sooner are they finished than the men have to begin again. In this way every square inch of steel comes under observation at least once in three years. The staff of men employed varies in number from the maximum of 35.

In order to obtain access to the various parts, Mr. Adam Hunter, the resident engineer, has devised an elaborate series of ladders and lifts, which form no part of the original design. Wherever practicable, ladders attached to the permanent structure are used, but in order to reach the higher parts it has been found necessary to provide lifts. There are three such lifts, worked by steam engines and winches placed almost out of sight a little below the level of the permanent way. At each hoist there is also a shelter house where the paint is mixed. In order to reach the parts below the rails, platforms are strung from wire ropes run along either side of the bridge, and the platforms being movable, they can be pushed along the steel ropes on the principle of an overhead railway. A squad of men precedes the painters, erecting the platforms and rigging up the tackle from which they are suspended. The work proceeds daily except on Sundays and in very stormy weather. It is a striking tribute to the ability of those engaged in maintaining the bridge in good order that in no case has any part required renewal.

Purity of Air in Tube Railways.

Dr. A. Wynter Blyth, President of the Incorporated Society of Medical Officers of Health, contributes an article to Public Health, in which he gives the results of his tests of the ventilation of the Two-penny Tube. "In front of each train," he says, "there is a distinct and measurable increase of barometric pressure, in the rear a diminution of pressure. As each train leaves a station it pushes a column of air in front of it, part of which, on reaching the station, rushes up the staircase into the open air, and as the train leaves the station air rushes down the staircase from the street. The downward or upward velocity varies with the position of the trains." Taking the whole results, they show that, so far as respiratory impurity goes, the tube railway gives better results than the Underground railway, and better results than in ordinary places of assembly. Even in a crowded lift the sojourn is too short to contaminate the air seriously, and since each lift when it ascends to the level of the street has the advantage of thorough ventilation, the transient contamination of air during the sojourn gets swept away. The amount of carbon dioxide on the platform of the stations appears to be from about 9 to nearly 11 per 1,000. The research clearly shows that, although there is so much movement of air, so much sucking in from above and blowing out from below, a good portion of the air must be driven backward and forward unchanged in the tubes; in other words, the tunnel air is diluted, but the whole of it is never swept out. The mere stoppage of trains would not so seriously interfere with the air supply as to render the supply incapable of supporting life.

Mr. Donald Murray has been carrying out a prolonged series of experiments with his long-distance, high-speed, page-printing telegraph system upon the trunk telegraph wire of the British post office between London and Glasgow. Although the conditions for the trials were distinctly unfavorable, he obtained a speed of 120 words per minute, which is only ten words less than the maximum he claims for his invention, so that the test was satisfactory. He found in the course of his experiments that although the automatic typewriting transcriber was capable of a speed of 110 words per minute, it evinced a tendency to drop letters while writing at that velocity, so he utilized two transcribers working at 70 words a minute, transcribing alternate batches of messages. By this means the apparatus was proved to work satisfactorily. Mr. Murray, at the conclusion of his experiments upon the English wires, is going to Vienna to carry out similar trials upon the telegraph systems of the Austrian government.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

FEED DEVICE FOR THRESHING-MACHINES.—JOHN F. WELCH, Braman, Oklahoma Ty. The feed device is constructed so that, after the band-cutters have acted upon the bands, the bundles of straw will be thoroughly shaken up, loosened, or separated, and delivered in that condition to the cylinder and concave without danger of "slugging" the cylinder. A series of knives is arranged in opposition to the teeth of the cylinder. The knives correspond in number, and, as a whole, in position, to a row of cylinder teeth. The knives serve to render the bands of the bundles into fragments before the bands are taken up by the cylinder.

COUPLING-FRAME.—SAMUEL C. ROCK, Quincy, Pa. The coupling-frame is to be used on threshing and other heavy machines and in connection with traction-engines. A novel construction of coupling-frame is provided for use between the machine and the engine, and by which the position of the parts can be quickly adjusted in order to back the machine into a barn-door or through any other narrow opening.

COTTON-CHOPPER.—GEORGE BERRINGER, Blanco, Texas. The invention is an improvement in cotton-choppers in which a device in the nature of a hoe-blade is attached to a lever-arm adapted to swing vertically, whereby it chops out some of the standing cotton plants as the machine advances, thus leaving the plants in bunches as desired. The present invention provides simple and ingenious improvements in the driving mechanism.

Drying Apparatus.

FRUIT-DRIER.—WILLIAM A. CATES, Fisher, Wash. This improved fruit-drier is of such construction that the application of heat from the entrance of the fruit or other substance into the drier to its removal therefrom is gradual. The discharge of the currents of hot air into the drying-chamber can be easily regulated to suit particular requirements.

HEATER.—JAMES A. DEZELL, Kingston, Ala. The heater is particularly applicable to lumber and other driers. The construction comprises inclined steam-pipes from which connection-pipes rise. Heads are located at the upper ends of the connection-pipes; and inclined tubes closed at their upper ends are connected with the heads. Steam passes through the inclined-tubes, the connection-pipes, and the heads, to the inclined-tubes, which act in the same manner as the sections of a radiator. Any condensation product flows down the inclined-tubes to the head, and to the connection-pipes, thus reaching the inclined main steam-pipe and passing to a water track.

Engineering Improvements.

BOILER.—CORNELIUS J. CRONIN, Youngstown, Ohio. The boiler is a water-tube boiler in which the water-carrying pipes are so disposed that they will be more effectively subjected to the action of the furnace fire, whereby the efficiency of the boiler is augmented. In order to increase the capacity of the boiler additional tubes arranged in layers are supplied. A convenient means for cleaning the tubes and removing defective tubes is provided.

ENGINE-SHAFT.—JAMES L. CLAYLAND, Fort Smith, Ark. The ordinary crank-shaft has but two points where full power is exerted and two "dead" points or centers where no power is applied. In the present invention the reciprocating motion of two pistons is applied to two spirally-grooved shafts through the medium of rotatable sleeves or hollow cylinders carrying a device which engages the spiral grooves. This arrangement is particularly applicable to marine and other engines as a substitute for ordinary crank-shafts.

COMPOUND ENGINE VALVE.—SWEENEY MUNSON, Alliance, Neb. The object of the invention is to provide a valve and corresponding parts which can be used in connection with compound engines, and which will, at the same time, combine extreme simplicity with certainty of action. The valve can be completely balanced, so that very little power is required to move it.

Mechanical Devices.

MACHINE FOR BENDING SHEET-METAL PLATES.—AUGUST SWOBODA and HERMANN ROTHE, Berlin, Germany. The present invention relates to a sheet-metal bending machine, the object of which is to bend sheet-metal plates in two different directions. The machine is principally adapted for the treatment of metal plates intended for use in the manufacture of cups or curved flanges for the bells or domes of gas holders.

MACHINE FOR CUTTING PATTERNS.—JAMES SULLIVAN, Manhattan, New York city. A knife is used in connection with a feed and is given a vertical movement, the knife being so secured and the machine so constructed that the point of the knife will not rise above the feed. The machine has a presser-foot and a feed so arranged that the knife can be employed for cutting fabric in any desired number of layers along the outline of any desired pattern.

WINDMILL-POWER.—CARL OBERLANDER, Arastra, Colo. Mr. Oberlander has devised improvements in windmill-power or mechanism, which mechanism is of such design that it can be quickly thrown into and out of operative position. Furthermore, the operation of the mechanism is such that there will be no lost motion.

MIXER AND KNEADER.—LOUIS COHNHOFF, Mattapan, Mass. The machine is intended for mixing and kneading dough. The construction consists of a pan to which rotary motion is given; a pestle mounted to swing on a crosshead; a shaft; and an eccentric on the shaft, the eccentric and crosshead being connected. By means of the pestle a batch of dough of large size can be quickly kneaded.

GRASS-UPROOTER.—DAVID N. PHILLIPS, Whittington, Ontario, Can. The invention provides a compact, light, and durable machine designed to uproot deep-rooted buffalo, twitch, or quack grass and to deliver it free from dirt in windrows at the rear of the machine. The machine is under the complete control of the driver, and will not become clogged by stones. The machine may likewise be effectually employed for digging potatoes and freeing them from earth.

TUCKING-GUIDE FOR SEWING-MACHINES.—RUSSELL C. JOHNSON, Cincinnati, Ohio. Tucking-guides are sometimes made in one piece. Where they are bent to form the guide-flange they have a rounded surface, so that when the tucker is fastened to the bed-plate of the machine the cloth slips under the tucker, resulting in an uneven tuck. Furthermore, a one-piece tucker cannot be adjusted to the different feeds and feet of various machines. The present invention obviates these difficulties by providing a tucker made in two sections, adjustable relatively to each other.

TENSION DEVICE FOR KNITTING MACHINES.—GEORGE W. RUTH, Norristown, Pa. The invention relates to a device especially adapted to circular knitting-machines, by which device the web is drawn uniformly from the needles. A steady and regular tension on the web is thus secured with the result that more effective work is produced.

AUTOMATIC WEIGHING-MACHINE.—ALBERT ARTHUR, East Pittsburg, Pa. The object of the invention is to provide simple automatic mechanism for weighing granular material. A tilting-trough is pivoted within a receptacle and is equipped with a shiftable partition. A flexible connection permits the trough to have a certain amount of play independently of the partition when the trough changes its position. The partition subdivides the trough into compartments, in one of which the material is adapted to accumulate in such a way that its weight is imposed on that side of the trough which is to be forced downward by the load when the latter reaches a predetermined quantity.

EMBOSSING-MACHINE.—FREDERICK J. ALBRECHT, Manhattan, New York city. This apparatus is capable of embossing work quickly and effectively. The peculiar construction of the apparatus includes a die at each side of a vertical feed-roller, so that both dies can be worked simultaneously against strips of material driven by the feed-roller in opposite directions.

AXLE-SHAPING MACHINE.—DEFIANCE MACHINE WORKS, Defiance, Ohio. Mr. George A. Ensign, whose inventions we frequently have occasion to notice in these columns, recently devised a new and improved axle-shaping machine for the Defiance Machine Works. The machine is especially designed for the use of wagon and truck builders for turning the ends of wooden axles to the proper size and shape, and for fitting the interior of either large or small metallic axle-skeins. The machine is arranged to give the desired gather to the axle-ends and to prevent a tendency to twist or spring the bed out of alinement, and to insure an uncramped movement of the working parts, thereby increasing the capacity of the machine and raising the quality of the work.

STOP-WATCH.—SAM GOLDFADEN, Manhattan, New York city. The inventor has provided a construction by which a start, stop, and fly-back seconds-hand can be readily fitted to time-keeping watches, thus adapting such watches for timing horse races. The construction is simple and is adapted for attachment to ordinary watches, even of the cheapest grades.

Railway Appliances.

BALLAST CONVEYER AND LEVELER.—GREEN F. SPURLIN, Camden, Ala. The invention relates to means for transferring sand and ballast from cars on a railroad-track to fill in the spaces between cross-ties and also for leveling the filling material. The device provided for this purpose permits the convenient conveyance and discharge of the ballast from an ordinary platform-car at each side, between the track-rails. A ballast-leveling device co-acts with the conveyer to complete the ballasting of the roadbed at one operation.

CAR COUPLING.—MARK A. BROWN, Douglas, Ga. The invention relates to a device comprising a pivoted coupling-head and a coupling proper. The drawhead is provided with a beveled surface; and upon the drawhead a coupling-head is pivoted centrally. Upon the coupling-head a radially movable member is pivoted eccentrically. The arrangement is such that the path of the radially-movable member is partially bounded by the beveled surface, whereby the entire structure is rendered compact and strong.

Vehicles and Their Accessories.

BRAKE.—THOMAS G. BLATCH, Hazleton, Pa. The brake is more especially designed for use on steam-carriages. The construction comprises a brake-band suspended from its middle, provided with loose ends and bent into cylindrical form. Radial brackets having arc-shaped bases are mounted upon these free ends. A lever provided with a bent portion is pivoted directly upon the extreme outer end of one of the brackets; and a link is pivoted upon the extreme outer end of the other bracket and upon the lever. The arrangement is such that in applying the brake the link and the bent portion of the lever move toward each other and toward a common dead center.

PNEUMATIC TIRE PROTECTOR.—CLARENCE G. DINSMORE, Staatsburg, N. Y. This protector for the inner tube of a double pneumatic tire is designed to prevent deflation by puncture. The protector is designed for use in double-tube tires employed on the wheels of automobiles, bicycles, and other vehicles. A shield is interposed between the outer and inner tube. The ends of the shield overlap and are free to permit a yielding movement lengthwise. Outwardly-extended flanges of the shield are arranged to embed themselves in the material of the outer tube to hold the shield in place.

BICYCLE SUPPORT.—VICTOR M. GABRIELLE, Daytona, Fla. The invention provides an improved fastening by which to prevent the front wheel from turning when the bicycle is supported in idle position. A clasp embraces the frame bar of the bicycle; and to this clasp a supporting bar is pivoted. Wheel-fastening devices are employed comprising a clasp embracing the post of the bicycle; a bolt connecting the ends of the clasp and a bracket carried by the bolt and arranged to form a support for the swinging end of the bicycle support.

DRIVING GEAR.—CHARLES M. LEECH and SEYMOUR D. EVANS, Lima, Ohio. The invention is a frictional gearing for use on automobile vehicles, and also on marine vessels. Beveled friction-wheels are mounted to turn with a drive-shaft, which friction-wheels can be slid on the drive-shaft. A second shaft is disposed transversely to the drive-shaft and is arranged to slide on and rotate in its bearings. To this second shaft a friction-wheel is fastened, which is adapted to be engaged by either of the first-named friction-wheels. By means of a gear mounted on the second shaft the movement transmitted by the friction-wheels can be imparted to other elements.

WHEEL-FASTENER.—AUREN M. BEEBE, Banner, Ill. The invention provides a simple device by means of which a wheel can be quickly fastened to its axle or released therefrom. The use of the usual nuts, which are liable to become loose, is obviated. The axle has an annular channel at its end in which segmental locking-plates pivoted to the wheel-hub are to be engaged. Links extend from the free end of the plates and are operated by a crank to move the plates in the desired position.

Tools and Apparatus for Special Purposes.

FLUE CUTTER.—CHARLES A. SWANSON, Kinbrae, Minn. The tool is to be employed for the removal of tubes or flues from boilers by cutting the body of the flue loose from its ends that are secured in the flue-sheets. The present flue-cutter is a practical device of novel construction, effective in service, and adapted to cut off flues or tubes which vary considerably in diameter.

SCRAPER.—MORITZ M. MÜLLER, Bronx, New York city. Mr. Müller has provided the hook which truckmen commonly employ in handling dry goods cases, with a scraper to remove printed matter which has been marked on the case, and with a claw to remove nails.

FORMER FOR AIR-CHAMBERS FOR DENTAL PLATES.—LOUIS ARNDT, Jersey City, N. J. By means of this invention offsets can be produced directly upon a dental mold or cast of the mouth for the purpose of producing air-chambers and lateral-chambers in a plate for artificial teeth. The form is conveniently applied to the main cast and manipulated by one hand.

KNIFE AND SCISSORS SHARPENER.—CHARLES A. PAYNE, St. Paul, Minn. The invention embodies blades set at an angle to each other, so as to dispose their scraping edges for engagement with the sides of a knife or scissors blade to sharpen the edges. Novel details of construction have been invented to adapt the device for very effective service.

NAIL CUTTER AND FILE.—EMIL FORQUIGNON, Manhattan, New York city. The finger-nail cutter and file has a pair of cutters curved reversely to the edge of the nail to be cut. The cutters are pivotally connected with each other. A file is hinged on one of the cutters and is adapted to engage the other cutter to close it.

Miscellaneous Inventions.

HOOF-PAD.—JOHN CAMPBELL, Manhattan, New York city. The invention relates to a hoof-pad especially adapted for horses having corns. These corns in most instances form around the frog of the hoof, and the present invention provides a form of pad which will relieve a hoof afflicted in the manner mentioned, by placing the weight and concussion on the heel and frog of the hoof.

PROCESS OF MAKING SODIUM AMALGAM.—EUGENE B. SMART, Florence, Colo. Paraffin is heated to its melting point and to that of the alkali metal. The metal is then added to the melted paraffin and the heat continued until all the metal is heated. The amount of paraffin employed is sufficient to cover the metal when both are melted. Mercury is then added to the melted mixture of paraffin and the metal, and the paraffin is then decanted.

SAFETY-RAZOR.—ALBERT L. SILBERSTEIN, Manhattan, New York city. The blade can be readily and accurately inserted relatively to the guard and can be held in position whether it be thick or thin, worn out or new, without requiring adjustment of the parts. The guard and the casing can be easily cleaned.

EXPANSION-JOINT.—RALPH E. VAIL, Mount Vernon, Ohio. The invention is particularly applicable to pipe-lines. The expansion-joint connects the adjacent ends of two pipes with each other, and is arranged to allow free expansion and contraction of the line without danger of leakage. In case of a leak or break, the pipe is cut in two at the enlarged portion; and then the expansion-joint is placed in position on the adjacent pipe ends.

BUNG.—RUDOLPH SPAHN, Brooklyn, N. Y. The bung is provided with a sort of clack or valve which normally closes to prevent the escape of liquid from the cask, but which opens under the pressure of a spigot or other instrument inserted in the valve. The present invention insures the closing action of the valve.

CUSHION FOR SHOE-HEELS.—LOUIS SCHWARZ, Jersey City, N. J. The purpose of the invention is to provide a cushion for shoe-heels which will be as effective as a rubber heel, but which will enable the lower lifts of the heel to come in contact with the ground. The cushion is so constructed that it rests between the sole and the top lift of the heel, or the main and insole.

HAT-SHADE.—WILLIAM A. HAYWOOD, Denver, Colo. The shade consists of a frame formed of two pairs of bars, the members of which pairs are pivotally connected between their ends. The pairs of bars are pivoted together at their inner adjacent ends. A side bar is located at the side of each pair and extends outwardly. A fabric covers the bars. The shade protects the wearer from the sun, and its construction is such that it can be readily folded when not in use.

CURRYCOMB.—SAMUEL B. FELTY, Penbrook, Pa. After a few minutes' work the ordinary currycomb becomes clogged with hair and dandruff, so that it must be cleaned at the expense of some time and labor. The present invention avoids this disadvantage by providing a single plate which has serrated edges and which is held on the handle so that it lies, when at work, at but a slight inclination to the surface to be cleaned. With such an instrument it is impossible to clog the teeth to any great extent; and the accumulations which do form can be readily dislodged by jarring the comb in the usual manner.

GARBAGE-HOLDING ATTACHMENT FOR SINKS.—CHARLEY E. COX, 4821 North Clark Street, Chicago, Ill. This sink-attachment is not only trapped against gases or odors from the main or sewer, but is also trapped at the top against gases and odors arising from the liquid held in the attachment itself. The construction is such that the several parts can be disassembled and easily cleaned.

Designs.

BELT.—LOUIS SANDERS, Brooklyn, New York city. The leading feature of this belt is to be found in upper and lower parallel bands and an independent plaited strap carried between the bands. A space intervenes the contiguous edges of the central and outer members.

PLOWSHARE-LAY.—WILLIAM GIBSON, JR., Wolseley, Assiniboia, N. W. T., Canada. The plowshare consists of a body portion having its opposite edges convergent and meeting at the lower end in an inclined curve. These opposite edges are longitudinally-curved inward and meet at the upper end with a reduced portion of the shank. By reason of this peculiar construction the lays can be kept in stock so that it is not necessary to go to a blacksmith to repair a plow.

SHOE-SOLE.—JOHN S. BUSKY, New York city. The leading feature of the design consists in lateral projections at the junction of sides of the shank with the heel. These projections extend out from the side planes of the heel.

BELT.—BERNHARD WILENTSHIK, Manhattan, New York city. The belt is composed of a band of single pieces resembling leaves.

PEN-HOLDER.—NELS JACOBSON, Rib Lake, Wis. The essential features of the design are to be found in an indentation in the top of the pen-holder, an indentation in the side and rearward of the first indentation, and an indentation at the side opposite the second indentation and lying slightly forward of the first indentation. These indentations fit the fingers so that the pen can be firmly grasped.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1951.—For manufacturers of novelties, such as can openers, needle threaders for sewing machines, needle-threading thimbles, etc.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1952.—For a device for holding covers on foot of bed.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1953.—For manufacturers of balloons.

Stencil Machines.—A. J. Bradley, 101 Beekman St. N.Y.

Inquiry No. 1954.—For the manufacturers of the Light & Champion hay presses.

Metal substitute. Crane Bros., Mfrs., Westfield, Mass.

Inquiry No. 1955.—For manufacturers of ditching machines.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1956.—For dealers in machine shop equipments.

Glass paper-weights for advertising. Write for prices. Lobmiller Co., Wellsburg, W. Va.

Inquiry No. 1957.—For dealers in light-weight steam engines.

WANTED.—Address of wire machine manufacturers. Johnston & Sword, Toronto, Canada.

Inquiry No. 1958.—For dealers in grooved steel wire for umbrella ribs.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1959.—For manufacturers of gunsmiths' tools and materials.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1960.—For manufacturers of steam, gasoline, kerosene or hot air engines of about ½ horse power.

Let me sell your patent. (No advance fees.) Chas. A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 1961.—For dealers in the prepared Ramie fiber.

For sheet metal stampings and novelties try Standard Stamping Co., Seventh and Hudson, Buffalo, N. Y.

Inquiry No. 1962.—For dealers in machines for soldering cans.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1963.—For machines for sorting, cleaning and cutting sardines before packing.

Are you looking for anything in bent woodwork? Write Tucker Bicycle Woodwork Co., Urbana, Ohio.

Inquiry No. 1964.—For a 250 to 350 light 110-volt dynamo and engine direct connected.

Gear Cutting of every description accurately done. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N.Y

Inquiry No. 1965.—For dealers in raw rubber.

Metal cut, bent, crimped, embossed, corrugated; any size or shape. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 1966.—For manufacturers of "steel bowling alleys."

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 1967.—For manufacturers of scales.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1968.—For dealers in special tools.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1969.—For dealers in tools and model supplies.

NOVELTY CO.'S, ATTENTION.—Patent No. 680,463 for sale or royalty. Sticky Fly Paper Bracket, hangs up, keeping paper out of the way and out of sight. Cheap in construction. F. H. Plaistridge, 805½ S. Spring St., Los Angeles, Cal.

Inquiry No. 1970.—For parties to make model of a machine having mechanism similar to that of a typewriter.

Inquiry No. 1971.—For makers of woodworking machinery, tools, etc.

Inquiry No. 1972.—For manufacturers of mica globes.

Inquiry No. 1973.—For manufacturers of eight-day clocks adapted to closing an electric circuit once in 12 or 24 hours.

Inquiry No. 1974.—For parties handling oilstone in bulk.

Inquiry No. 1975.—For parties to manufacture all-metal mail cranes.

Inquiry No. 1976.—For machinery for making cords and tassels of cotton and silk.

Inquiry No. 1977.—For makers of canners' machinery.

Inquiry No. 1978.—For makers of pure gum caoutchouc.

Inquiry No. 1979.—For manufacturers of ice-crushing machines or ice crackers for soda fountain.

Inquiry No. 1980.—For manufacturers of bag-making machinery.

Inquiry No. 1981.—For manufacturers of wire novelties.

Inquiry No. 1982.—For manufacturers of small figures of animals and persons of papier maché.

Inquiry No. 1983.—For makers of electric drills.

Inquiry No. 1984.—For western makers of round basswood sticks 5-32 inch by 7 inches.

Inquiry No. 1985.—For an ice plant of about 10 tons capacity.

Inquiry No. 1986.—For small ice machines about 100 or 300 pounds per day.

Inquiry No. 1987.—For dealers in fancy printed tin boxes for drugs, etc.

Inquiry No. 1988.—For manufacturers of printer's type-making machinery.

Inquiry No. 1989.—For manufacturers of rubber stamps, vulcanizers, tools, etc.

Inquiry No. 1990.—For dealers in small gas engines and dynamos for lighting plant.

Inquiry No. 1991.—For an apparatus for making fuel gas from coal.

Inquiry No. 1992.—For small motors that are self-starting under full load.

Inquiry No. 1993.—Wanted, to buy or lease grip, muscle or other slot machines.

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Fastenings, machine for inserting metallic, L. A. Casgrain ... 691,354

Faucet and valve, E. A. Pohlman ... 691,569
Feed distributer, W. B. Campbell ... 691,439
Feed regulating apparatus, automatic, G. Hoepner ... 691,627
Fence, D. L. M. Titsworth ... 691,504
Fence, portable cable anchor, A. L. West ... 691,425
File case, Hoffman & Magie ... 691,628
File or rasp cutting machine, J. Greene ... 691,622
Filter, metallurgical, F. H. Long ... 691,706
Filtering and regulating device, M. M. Brophy ... 691,529
Fireproof floor, O. Hoff ... 691,466
Fish plates in the process of manufacture, apparatus for cooling, R. B. Charlton ... 691,355
Fishing float, A. N. Pacetty ... 691,407
Float, glass, J. M. Burr ... 691,530
Floor covering, M. Barnett ... 691,434
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Fly wheel, C. Robinson ... 691,491
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Fruit gatherer, J. D. Carter ... 691,595
Fruit jar and cover, Donald & Bussey ... 691,366
Fruit picking sack, E. Harter ... 691,376
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Furnaces, apparatus for supplying air to steam generator, C. Voet ... 691,679
Furnaces of steam boilers, etc., draft apparatus for, J. W. Stock ... 691,672
Garment stretcher, W. D. Ashworth ... 691,573
Gas engine, C. Robinson ... 691,489
Gas generator, acetylene, W. W. Cozins ... 691,357
Gas governor, J. Zander ... 691,429
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Gate, A. J. & W. H. Russell ... 691,409
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Gearing, A. T. Brown ... 691,591
Gearing, L. Jones, Jr. ... 691,634
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Glass bottles, finishing mold for making, L. Grote ... 691,463
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Handle fastener, L. Herrman ... 691,377
Hanger. See Drapery hanger.
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Harrow tooth fastening, S. D. Poole ... 691,660
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Hat, miner's, A. Harris ... 691,623
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Hay loading apparatus, F. S. Church ... 691,714
Hay rack, F. E. Bright ... 691,527
Hinge, J. C. Gillispie ... 691,620
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Pipe cutter, G. Mitchell ... 691,649
Pipe fittings, manufacture of, C. A. Dies ... 691,454
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Plow, K. Herrling ... 691,464
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Press for oleaginous substances, Zoder & Hayne ... 691,430
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Railway tie, metallic, W. H. Meiser	691,647
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Rock drill, H. Leineweber	691,556
Rolling metal ingots into thin plates or sheets, E. Norton	691,565
Rolling solid or hollow bodies, apparatus for, J. Giesholdt	691,540
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Spark interrupter, T. von Zweigbergk	691,693
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Stump puller, M. W. Mashburn	691,645
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Tobacco drying and cooling system, W. E. Martin	691,723
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Tool handle, J. Mueller	691,562
Tool, motor fluid operated, H. H. Vaughan	691,420
Tool, rotary, F. D. Chambers	691,596
Trace fastener, L. C. Balinger	691,575
Trace support, H. Brooks	691,590
Tramways or railways, subterranean current transmission for electric, A. Hrebicek	691,381
Trees, protecting, T. J. Hubbell	691,546
Trousers creasing device, W. W. Fulton	691,460
Truck, baggage, C. T. Godard	691,542
Truss, pile, C. W. Langridge	691,392
Tubes, etc., manufacture of seamless and weldless, B. F. McTear	691,727
Type mold, H. J. S. Gilbert-Stringer	691,619
Typesetting or linotype machines, composing mechanism of, A. Bean	691,583
Typewriter, Consentino & Palumbo	691,601
Typewriter paper guide, A. Swindlehurst	691,503
Valve, A. H. Marscher	691,400
Valve device, A. J. Murphy	691,477
Valve, float, C. C. Cecil	691,444
Valve gear, engine, O. Jackson	691,384
Valve, suction, O. H. Castle	691,443
Vehicle body, metallic, H. F. Eastman	691,455
Vehicle box, L. Priest	691,661
Vehicle brake mechanism, motor, W. H. Mason	691,724
Vehicle drag, M. Leatherman	691,554
Vehicle mud guard, T. Cochrane	691,445
Vehicle wheel and tire, C. Howells	691,467
Vending apparatus, coin controlled, Newman & Borsodi	691,564
Vessels, apparatus for indicating, recording, and integrating the speed of, C. E. Delanoy	691,451
Wagon brake, J. H. Jenner	691,547
Wagon brake rachet, J. J. Shipley	691,670
Wardrobe and traveling trunk combined, E. Wolfgang	691,518
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Washing machine, Hughes & Barnes	691,468
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Water cooler, T. F. McEvilly	691,655
Water heater, steam, M. M. Brophy	691,528
Water joint, M. Garvey	691,539
Water purifier and filter, portable, C. E. Holland	691,545
Weighing machine, W. F. Brothers	691,438
Weighing machine, C. O. Ericson	691,536
Welding apparatus, tube, T. J. Bray, Jr.	691,350
Welding machine, portable electric, H. E. Meyers	691,404
Wheel, S. Furmidge	691,717
Wheel controlling mechanism, T. Quinn	691,663
Whiffletree connection, A. H. Shuel	691,496
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Wire stretcher, L. J. Bandemer	691,521
Wood cutting machine, E. Wuhrmann	691,428
Work holder, N. P. Denckla	691,364
Wrench, W. H. Landor	691,552
Writing machine, Hess & Stoughton	691,626

DESIGNS.

Pillow facing, C. E. Bentley	35,606
Pillow top, C. E. Bentley..........35,593 to	35,605
Shingle, G. F. Murdock	35,592
Watch bag, C. C. Drueding	35,591

TRADE MARKS.

Beef extracts, Liebig Extract Co.	37,660
Coats, trousers, and waistcoats, Standard Clothing Co.	37,654
Cotton flannels, W. H. Wisner & Co.	37,657
Fasteners, metallic, Parker Novelty Co.	37,667
Flour, William S. Hills Co.	37,661
Liniment, salve, and ointments, Geber Drug Co. of Baltimore City	37,663

(Continued on page 80)

Medicators, inhalers, respirators, and similar surgical appliances, E. J. Worst..	37,666
Millinery goods, certain named, Gage Bros. & Co.	37,653
Overshirts, Oppenheim, Oberndorf & Co.	37,655
Quinate of lithium, Vereinigte Chininfabriken Zimmer & Co., Ges. mit Beschrankter Haftung	37,664
Saws, back and butcher, Goodell-Pratt Co..	37,668
Shoes, F. E. Mistrot	37,658
Shoes for men, women, and children, T. E. Greacen	37,659
Soap and certain named toilet preparations, A. F. Wood	37,662
Syringes, Tyer Rubber Co.	37,665
Underwear, Iroquois Knitting Mills	37,656
Washing machines, Voss Bros. Manufacturing Co.	37,669

LABELS.

"Aceton," for a medicine, Aceton Medical Co.	8,915
"Anti-Whoop," for a medicine, F. C. Titzell	8,914
"Butter Nut Bread," for bread, Schulze Baking Co.	8,918
"Dermicure," for a medicine, G. B. Holden.	8,917
"Dr. Ling's Lemon Cough Remedy," for a medicine, Patton Bros.	8,916
"Eagle India Ink," for ink, Schwencke, Kirk & Co.	8,912
"Hygeia Flour," for flour, Michigan Milling Co.	8,906
"Keystone Maid," for cigars, H. Sommer..	8,904
"La Vitalia," for cigars, H. Sommer	8,905
"Lifebuoy Soap," for soap, Lever Bros.	8,910
"Napoleon French Limburger," for limburger cheese, Liebenthal Bros. & Co..	8,909
"Nature's Breakfast Food," for a wheat food, Nature's Breakfast Food Co.	8,908
"Pacific Oil Compound," for an oil compound, S. A. Dennis	8,911
"Sopura Dentifrice," for tooth powder, Sopura Co.	8,913
"Toasted Manna," for a food product, Lambert Good Food & Machinery Co.	8,907

PRINTS.

"The Hawaiian Souvenir Playing Cards," for playing cards, United States Playing Card Co.	455
"The Hunt Back No. 606 Congress Playing Cards," for playing cards, United States Playing Card Co.	453
"The Minuet Back No. 606 Congress Playing Cards," for playing cards, United States Playing Card Co.	452
"Vestibule Limited," for playing cards, New York Consolidated Card Co.	454

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS, ETC.

Recherches Minières Guide Pratique de Prospection et de Reconnaissance des Gisements à l'Usage des Ingenieurs et des Propriétaires de Mines. Suivi de Notions Abrégés sur l'Emploi dans l'Industrie des Minéraux les plus Usuels. Par Félix Colomer, Ingenieur des Mines. Paris: Veuve Ch. Dunod, Editeur. 1901. Octavo. Pp. 270. Price $1.75.

Taschenbuch der Deutschen und der Fremden Kriegsflotten. Mit teilweiser Benutzung amtlichen Materials. III. Jahrgang. 1902. Herausgegeben von B. Weyer, Kapitänleutnant a. D. München: Verlag von J. F. Lehman. 1902. Pp. 304. 16. Price 75 cents.

We have had occasion to comment favorably upon the excellent naval handbook which Capt. Weyer published last year. The little book before us is, if anything, better than last year's production. So far as accuracy of information goes and general trustworthiness, it cannot be denied that the work is fully as valuable as the larger naval annuals. Of particular service are the excellent tables which have been compiled for the purpose of showing the relative efficiency of ordnance of the various navies. Interesting articles on naval topics will be found in the latter part of the book. Of these, a discussion of England's ability to maintain her preponderance of power over two combined European navies is, perhaps, the most noteworthy.

The Principal Methods of Organic Chemistry. By Ludwig Gattermann, Ph.D. Translated by William D. Schober, Ph.D. New York: The Macmillan Company. 1901. 16mo. Pp. 360. Price $1.60.

The author is professor in the University of Freiberg, and this book was written primarily on account of the private needs of the author. The work has proved so satisfactory for use in general that it has very wisely been translated by Dr. Schober, who is instructor in organic chemistry in Lehigh University. Organic chemistry is much simplified by works of this nature. The book is admirably illustrated and is well printed.

Linear Drawing and Lettering for the Beginner. By J. C. L. Fish. Palo Alto, Cal.: The Author. 1901. Oblong 12mo. Pp. 65, 4 sheets of figures.

The author states that a faithful following of the directions given in the book will, it is hoped, furnish the student enough training in the use of drafting instruments to enable him to construct accurate pencil drawings with the clear lines and do legible lettering. The directions are very common sense, and with the aid of a blankbook for lettering, it is possible for the student not only to learn to draw, but also to make neat letters.

CONTROL OF FIRE.—VALUABLE PAPER on fire extinguishment. Scientific American Supplement 1134. Price 10 cents. For sale by Munn & Co. and all newsdealers.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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Minerals sent for examination should be distinctly marked or labeled.

(8507) G. H. E. writes: In an informal conversation the statement was made that of the energy stored in a given amount of coal an extremely large proportion is lost in the attempt to employ it productively, as in the steam engine, and that the utilization of the energy wasted by the present methods is an important scientific and economic problem. This statement was challenged, and in the resulting discussion the following questions arose. 1. How large a proportion of energy stored in a given amount of coal is lost by methods commonly in use? A. From 20 to 25 per cent, and sometimes more, of the heat value of the coal is now lost. 2. At what stages in the process of transformation, and how, do the chief losses occur? A. Mostly by the heat going up the chimney, and to a small degree by bad stoking and radiation of heat from defective insulation of boiler setting and pipes. 3. What percentage of the energy in a given amount of coal can be (not is) used in producing steam? A. The possibilities for utilizing the full energy of coal are very small. Little may be expected over the best practice of to-day. It is the converting of the steam into active power wherein the trouble lies. 4. How is the amount of energy in a given amount of coal ascertained? A. The absolute amount of energy in coal is found, first by an analysis of its combustible constituents, from which the heat units are computed; second, by actual combustion of a given weight and measuring its heat producing property by absorption of the heat in water or by melting ice in a calorimeter.

(8508) J. A. M. writes: Will you kindly inform me whether the following facts are new, or only so to the writer? The mechanical equivalent of heat as given by Dr. Joule's experiment of a weight falling through air, actuating thereby wings in water, is 778 foot-pounds according to William Kent. Now you will note that the relative weights of water and air are as 1 to 774. Is there not an equation here between work, water, heat and air? Might not the slight variation of 774 and 778 pounds be due to the slip of the water? William Ripper gives the equivalent as 772 pounds. A. The mechanical equivalent of heat, which is called Joule's equivalent, as determined by Dr. Joule, was 772 foot-pounds. That is, to lift 772 pounds to a height of 1 foot requires the same amount of work as to heat 1 pound of water 1 deg. Fahr. This work was done between 1840 and 1843. Considering the advancement of mechanical science at that time it was a marvelous piece of work. He employed the friction of water and measured the heat produced. Joule also determined the equivalent by means of the electric current. Others investigated the same constant by other methods, the compression of metals, the specific heat of air, the induced electric current in metals, and the velocity of sound, with results fairly in agreement with that of Joule. Joule's method was that of direct determination of the number of foot-pounds of work used in actually heating one pound of water one degree. Other methods were indirect. That these coincided fairly well with the direct method was all that could be expected. All methods are open to errors, and more or less close approximations are all that could be attained. In 1879 Prof. Rowland took up the problem with the finest appliances of modern science. He employed water friction, as did Dr. Joule. His results were immediately accepted. Probably the work will not be done over again for a generation. Some of his results involved as many as 12,000 distinct observations. He proved that the mechanical equivalent varies with the temperature. Between 41 deg. and 68 deg. there is a change of nearly eight-tenths of one per cent in the latitude of Baltimore. The mean of Prof. Rowland's results is 778 foot-pounds, which for all ordinary purposes is at present considered the true equivalent. Prof. Rowland's experiments showed that the specific heat of water diminishes from 32 deg. to 84 deg., and then increases till the boiling point is reached. Rowland was able to produce a change of 63 deg. in the water where Joule could produce a change of only 1 deg. He also used the sensitive air thermometer instead of the slow mercurial thermometer.